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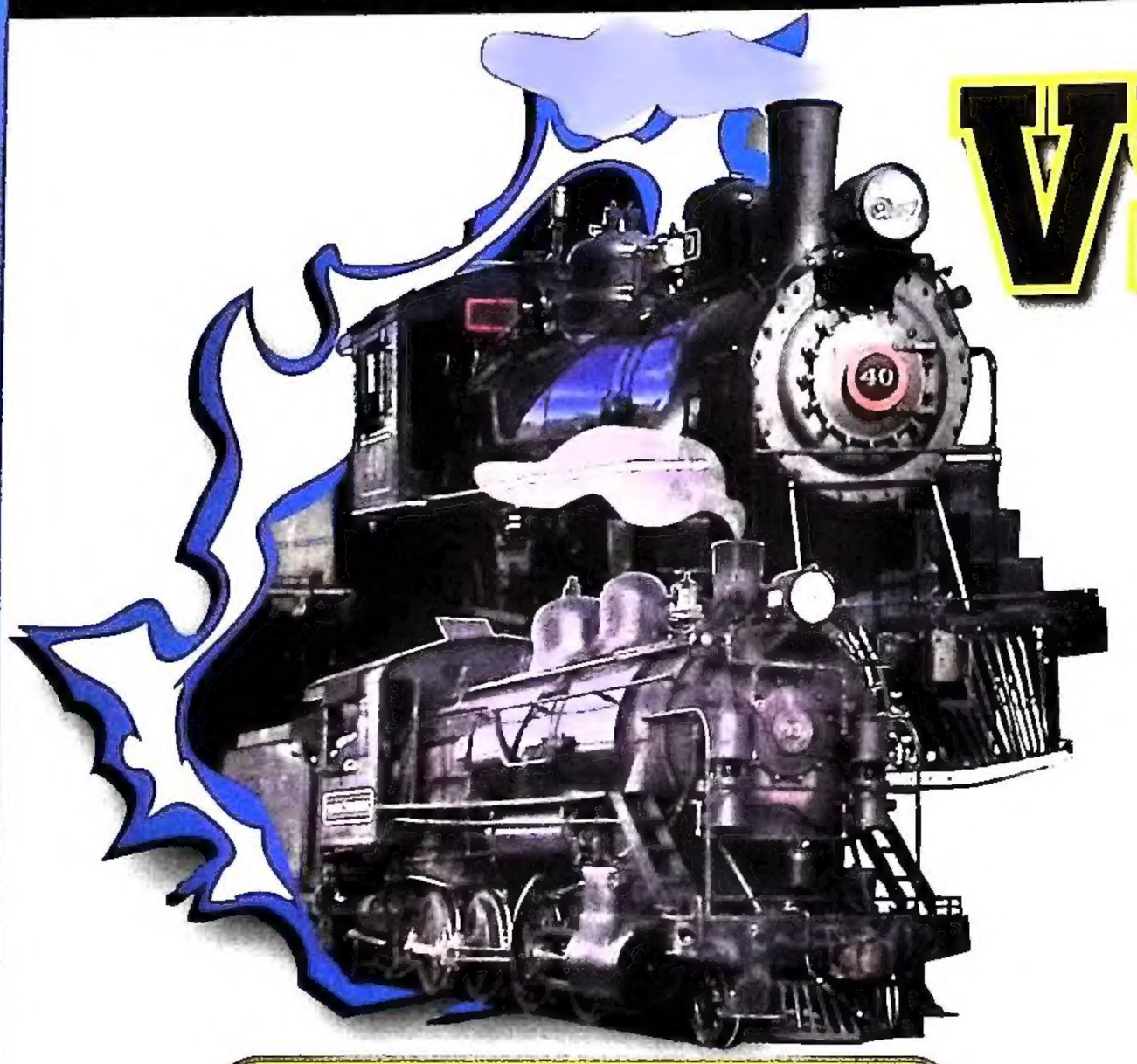

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# DIESEL VICTORY

## Railroading's epic switch from steam

Classic Trains

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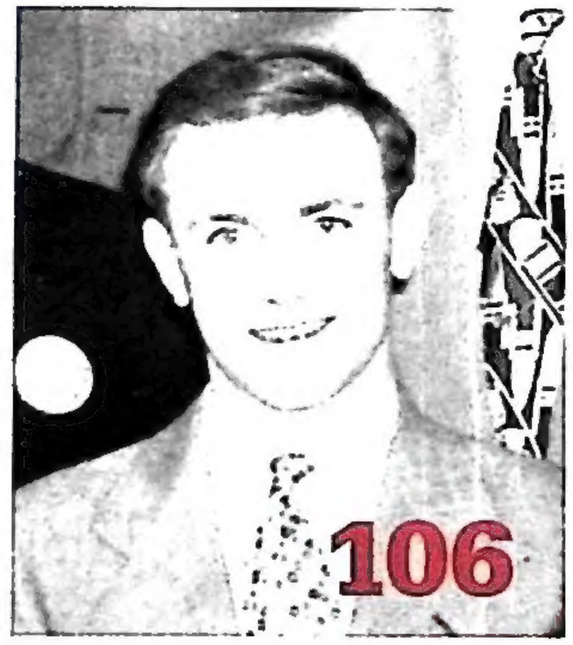
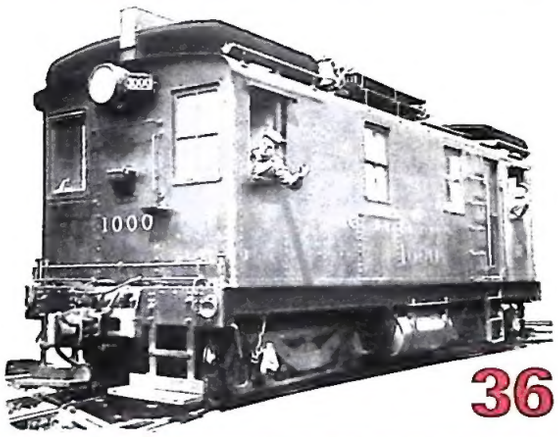


**ON THE COVER:** The diesel's ultimate victory over steam is symbolized by Baltimore & Ohio F3A 147 leading a freight past the engine-service area at North Vernon, Ind., as a 2-8-2, its career almost over, awaits its next duty in July 1956 in a photo by Walter G. Minnich Jr.



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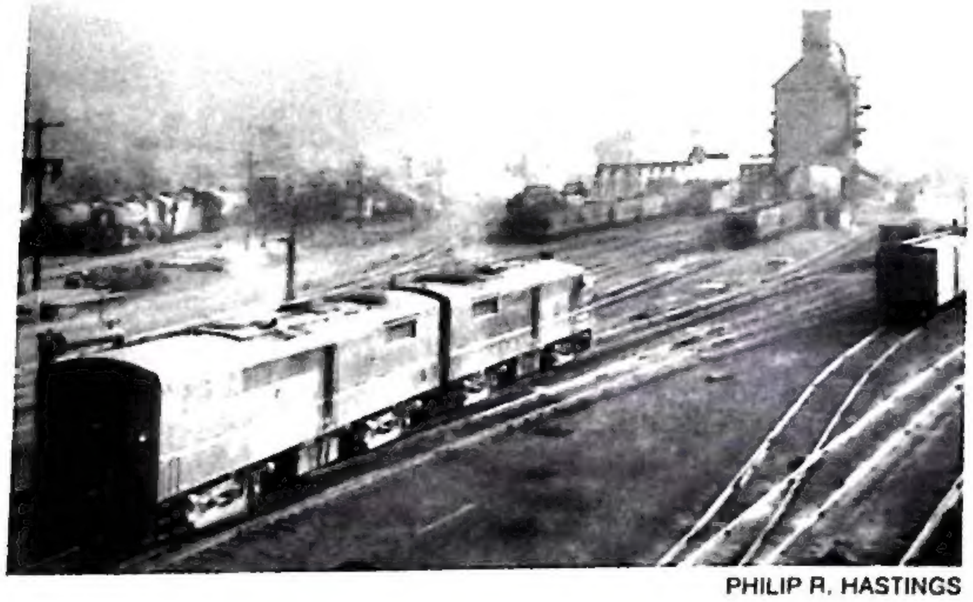
# The machines that saved railroading

In 1940, America's railroads were in the midst of a long decline that was about to get a lot worse. True, they ranked among the nation's leading industries, were recovering from the Great Depression, and would soon be handling the record-high traffic of World War II. But automobiles and trucks had been eroding the railroads' business for more than two decades, a trend that got a big boost with the 1940 opening of the Pennsylvania Turnpike, the nation's first long-distance, high-speed road and the template for the Interstate highway system begun in 1956. As rail revenues suffered, postwar inflation caused costs to soar. Though it was not apparent at the time, the steam-powered industry that built the nation in the 19th century was on a course to oblivion in the 20th.

It is fortunate, then, that railroading had something of a secret weapon in 1940—so secret, in fact, that many in the industry did not yet see its value. The weapon, of course, was the diesel-electric locomotive, the most potent version of which —Electro-Motive's FT—was roaming the nation on a demonstration tour. Diesels had made some inroads as switch engines and passenger-haulers, but the FT showed the diesel could handle the industry's bread-and-butter—heavy freight trains—more efficiently than steam could. Orders for the FT poured in, other diesel-builders came on-line, and within 20 years steam was essentially gone from U.S. and Canadian railroads.

An Alco FA-FB set looks lost in a world of steam at Pennsy's Renovo, Pa., yard, but within a few years these diesels and their brethren will have toppled such fortresses all across the nation.



PHILIP R. HASTINGS

And it's a good thing, for as historically significant and soul-stirring as steam is, it could never have seen railroading through the tough decades following 1940. That's a point Jerry Pinkepank makes in his lead-off article that begins on page 8, and it's why, in this Special Edition No. 4 of CLASSIC TRAINS, we celebrate the colorful, fascinating machines that, with their victory, saved railroading.

Robert S. McGonigal


DIESEL VICTORY

CLASSIC TRAINS SPECIAL EDITION NO. 4 • 2006

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| Editor | Robert S. McGonigal |
| Art Director | Thomas Danneman |
| Senior Editor | J. David Ingles |
| Graphic Designers | Chuck Braasch |
| | Kate Malloy |
| | Christy Weber |
| Editorial Assistant | Angela Pusztai-Pasternak |
| Librarian | Nancy L. Bartol |
| Publisher | Kevin P. Keefe |

DIESEL VICTORY (ISSN 1541-809X) is published by Kalmbach Publishing Co., 21027 Crossroads Circle, P.O. Box 1612, Waukesha, WI 53187-1612.

**Editorial**
Phone: (262) 796-8776
E-mail: editor@classictrainsmag.com
Fax: (262) 798-6468

**Display advertising sales**
Phone: (888) 558-1544, ext. 625
E-mail: adsales@classictrainsmag.com
Fax: (262) 796-0126

**Customer service**
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Outside U.S. and Canada: (262) 796-8776, ext. 818

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Single copy prices (U.S. funds): $8.95 in U.S.; $10.95 in Canada and other foreign counties, payable in U.S. funds drawn on a U.S. bank. Canadian price includes GST. BN 12271 3209 RT. Printed in the U.S.A.



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# Contributors

**CARL R. BYRON** ["Hermann Lemp: He Harnessed the Diesel," pages 46-48, and "Steam to Diesel on the Boston & Maine," pages 92-101] is a charter member of the Boston & Maine Historical Society. He has written numerous articles on railroad topics, including the B&M-MEC *Flying Yankee* [TRAINS CLASSIC 1999], Sleepy-Hollow coach seats [DREAM TRAINS 2003], and the Winton Engine Co. [STREAMLINER PIONEERS 2005]. He thanks the following people for their assistance with his Hermann Lemp article in this issue: Chris Hunter, Director of Archives, Schenectady (N.Y.) County Museum; Beth Scheraga, Awards Program Director, and Virginia D. Ward, Library & Journal Coordinator, Franklin Institute, Philadelphia; and Peggy W. Norris, Ridgewood (N.J.) Public Library.

**ROBERT T. GRAULTY** ["On the Road for Alco," pages 106-111] rode a lot of diesels during his four years as an Alco field engineer. To get to or from assignments, though, he rode plenty of steam engines, "which I loved," he says. His favorites? "New York Central Niagaras, at 90-plus mph . . . especially on the second or third sections of the *20th Century Limited* . . . following the lead sections, with restrictive signals popping up . . . automatic train control signal whistling . . . scooping water from track pans . . . the fireman constantly nursing his fire." When he left the road, Bob returned to engineering in Schenectady and worked on the development and testing of Alco's 251 engine. Then he went to Westinghouse, where he worked on several early military and civilian atomic-energy projects, including the USS *Nautilus*, the first nuclear-powered submarine, and the Shippingport, Pa., generating station, America's first commercial nuclear power plant. Now retired, Bob still does some manufacturing-related consulting work. He and his wife of 55 years live in Columbia, S.C., and have 7 children, 16 grandchildren, and 2 great-grandchildren.

**ERIC HIRSIMAKI** ["Not Built at La Grange," pages 54-63, and "Letter from FT 103," pages 102-105] lives in North Olmsted, Ohio, and is employed by the Cleveland-Cuyahoga Port Authority as Operations/Facilities Manager. He is the author of numerous books and articles, about both railroading and his other high interest, Great Lakes boats (that's him aboard the steamer *Charles M. Beeghly*). Eric has had two bylines in CLASSIC TRAINS, including "Turbines: King Coal's Battle Against the Diesel," in the Fall 2004 issue.

**KEVIN J. HOLLAND** ["Mr. Brooks and the Beardmores," pages 82-87] has an interest in Canadian railway motive power that encompasses diesel and steam operations on both of the country's transcontinental giants. He serves as general editor for the Canadian National Special Interest Group's forthcoming history of CNR dieselization, and is the author of a four-volume review of CNR and CPR steam from Morning Sun Books. A freelance writer and publications designer, Kevin lives near Toronto, Ontario. This is his fourth article in a CLASSIC TRAINS Special Edition.

**J. DAVID INGLES** ["Just Who *Was* the First to Dieselize?" pages 24-31] is Senior Editor of CLASSIC TRAINS and TRAINS magazines. A member of the TRAINS staff since 1971, he has been photographing diesels for almost 50 years. As a charter official of the GM&O Historical Society, he long has been intrigued by the central question of this article, and says he learned a lot from his research in trying to answer it. One surprising obstacle: the lack of specific dates of last steam runs in even "premier" resource publications for many railroads on his 1940's Class 1 "nominee list."

**GREG McDONNELL** ["Builder Profiles," pages 20-23, 32-35, 50-53, 64-66, 80-81, and 88-91, and "Timeline to Victory," pages 36-45] has been a contributor to TRAINS magazine for 26 years, with more than 40 feature bylines and credited news story contributions and hundreds of photo credits. He has authored nine books and is editor of Boston Mills Press's Masters of Railway Photography book series. An authority on diesels (even though he's pictured with Pere Marquette 2-8-4 1225),

Greg is the author of *A Field Guide to Modern Diesel Locomotives* (Kalmbach, 2002). He wrote about the Geeps built at GM's Ontario plant in "London's Pride and Joy" [Fall 2001 CLASSIC TRAINS]. In "real life," Greg has been a been a professional firefighter in his hometown of Kitchener, Ontario, for 31 years.

**JERRY A. PINKEPANK** ["How the Diesel Changed Railroading," pages 8-19] is an international railroad consultant based in Seattle, Wash. An early follower of diesel-locomotive matters, he founded the diesel news magazine *Extra 2200 South* in 1961 and authored the first and second editions of Kalmbach's *Diesel Spotter's Guide*. A native of Lansing, Mich., Jerry was educated at Michigan State University in nearby East Lansing and at Columbia University law school, and was employed by several railroads including New York Central, Burlington Route, Soo Line, and Burlington Northern. Recently he has authored several Morning Sun Books publications featuring photos by his friend Emery J. Gulash of New York Central, Wabash, Grand Trunk Western, and other Detroit-area railroads. Jerry wrote about the GTW in the Summer 2004 issue of CLASSIC TRAINS.

Steam's limitations were replaced by the diesel's endurance, flexibility, and standardization. The ways the diesel changed railroading were complex, but what could not be foreseen in the 1940's is that dieselization, then seen for its economy, was required to reach the level of performance the railroads needed for survival in the 1970's and beyond.

# How the diesel changed railroading

BY **JERRY A. PINKEPANK**

Leaving a steam-powered Pennsylvania Railroad train in their wake, brand-new E7's race out of Chicago with New York Central's crack *20th Century Limited* in summer 1945.

One September afternoon in 1945 at Fort Street Union Depot in Detroit, the leverman at Sixth Street Tower looked down with interest as two long, greenish-black, factory-fresh and shiny diesel passenger locomotives, coupled back to back, eased into the station and tied onto their train. He saw diesels every day—Pere Marquette had been operating Electro-Motive E6's through from Toledo, Ohio, on the Baltimore & Ohio's *Ambassador* since 1943, and even now a pair was idling at the head of that train as it prepared for departure for Washington, D.C.

The newcomers were different, however. They were E7A's, with gold PENNSYLVANIA lettering under five closely-spaced pinstripes gracing their flanks and converging under a red keystone on each glossy "bulldog" nose. Although the Pennsy had four arrivals and four departures a day from "Fort Street," including the separate New York and Washington sections of the *Red Arrow*, which were now set for departure in head-to-head competition with the B&O train, the Sixth Street leverman never saw a PRR locomotive in his interlocking plant.

Why? They were all too heavy for the half-mile 1893 viaduct carrying the station approach tracks above Jefferson Avenue. PRR trains had to be hauled by an FSUD 0-6-0 between the terminal and the foot of the viaduct, where K4s Pacifics waited to take charge. A K4s carried 209,300 lbs. on its driving wheels, and the viaduct was limited (for 4-6-2's) to 151,000 lbs. on drivers. Pacific types of the Pere Marquette and Wabash, the other two FSUD tenants, met the requirement, but PRR's did not. The diesels, although bearing 161,500 lbs. on each six-wheel truck, were "legal" on the viaduct because they had smooth electric drive without the dynamic augment that bridge engineers had to figure into steam locomotive "live load" calculations, caused by the rotating rods and counterbalances.

The Sixth Street leverman could see extra people in the cabs of the E7A's—

JAMES P. PRINGLE

TWO PHOTOS: ELMER TRELOAR

New order at Detroit: Three Pennsy E7's (left) ease onto the Jefferson Street viaduct, where K4's could not tread, in September 1947. One year earlier (top), E7 5858 and a sister lead the New York section of the *Red Arrow* out of Fort Street station. Soon, Fort Street's 0-6-0's would give way to two NW5's; No. 1 is seen in May 1948.

officials on hand to observe and supervise a new operation. The units' road numbers, 5900 and 5901, hinted at their status as first-of-class, and in fact they were the mighty Pennsylvania's very first road diesels. They tied on to the Washington section of the *Red Arrow*, train 80, which was scheduled to depart at 5:20 p.m., 15 minutes after train 68, the New York section, and 10 minutes ahead of B&O's *Ambassador*.

With the precision required by the competitive bunching of departures from the limited station facility, Fort Street's afternoon parade was rolling. At 5 p.m. the Wabash-PRR *Red Bird* left for Chicago behind a Wabash 4-4-2. This obsolete locomotive type was another testimony to the limitations of the Fort Street viaduct. Wabash had Pacifics light enough for it, but they had low driving wheels not suited to the *Red Bird*'s high speeds.

## LIMITATIONS

This word helps in explaining how the diesel-electric changed railroading. Suddenly, the locomotive was no longer the limiting factor in what could be achieved on any main line, in either tonnage handled or the speed in handling it. Instead, the limits became, to cite one major item, the strength of drawbars. On July 1, 1947, the grade B coupler, with its 350,000-lb. yield strength for drawbar force, was replaced as the Association of American Railroads standard for new equipment by the 550,000-lb.-rated grade C (later superseded by the 650,000-lb. Grade E). The AAR specifically stated that the 1947 change was due to the higher tractive effort resulting from the increased use of diesel locomotives.

Another limit newly confronted was the air-brake system and signal spacing, because with multiple-unit control, any railroad could assemble as much horsepower in one locomotive as its fastest schedule required, regardless of former civil engineering restrictions that had limited the size of steam locomotives on the routes of all but the financially strongest roads.

The Fort Street 0-6-0 moved the *Red Arrow* New York section out of the station as the Toledo-based PRR engineer on the Washington section contemplated his new surroundings, particularly the Electro-Motive man standing there, wearing—in a locomotive cab of all places—a white shirt

GLENDALE HOFFMAN; WILLIAM AYERS COLLECTION

**The PRR facilities at Crestline, Ohio, seen in a June 13, 1947, aerial view, exemplify the massive infrastructure required to keep a fleet of steam locomotives on the road. The S1 6-4-4-6 duplex is at middle left.**

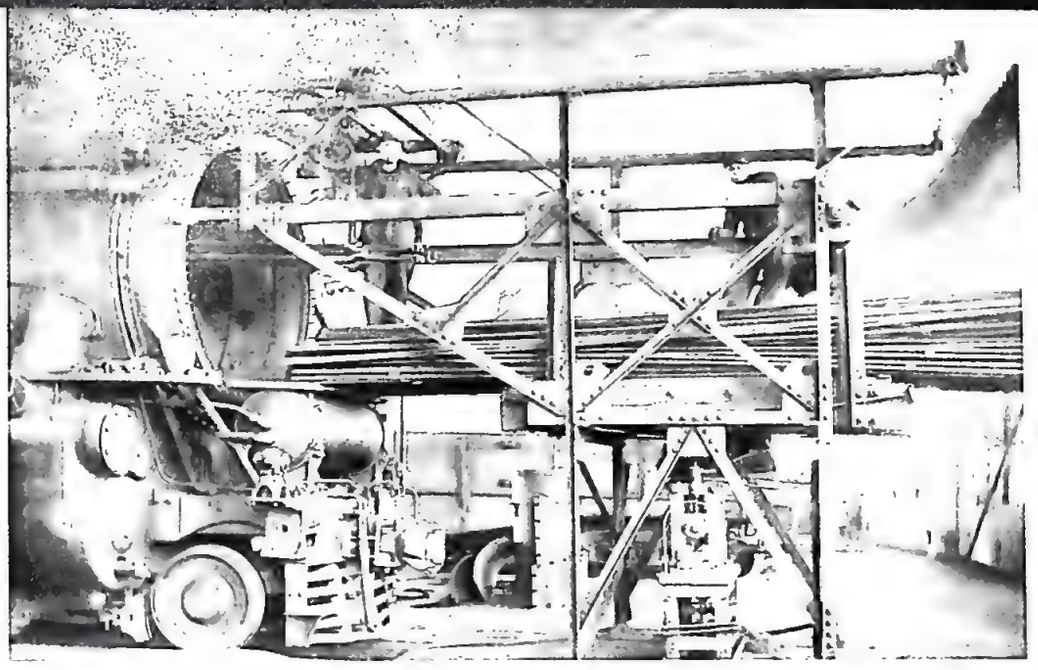
and tie! No coveralls! Hardly could that engineer imagine that within two years, he would come to work every day in a sport shirt and slacks.

Then, the communicating whistle sounded in the cab. The engineer whistled off (two sharp, goose-honk notes of the air horn, not a melodious steam whistle) and released the air. The road foreman cautioned him to open the throttle carefully. The viaduct was limited to 7 mph "at a uniform speed," and 4,000 horsepower was under his hand. Easing the throttle to first position and back to idle, then again to first position and back to idle, he felt the train come effortlessly into motion. Back in the coaches and Pullmans, passengers sensed motion outside their windows and realized they were moving, with none of the *tug*-relax-*tug* they associated with the start of a steam locomotive. This, the engineer might have thought, doesn't take much more skill than running a streetcar.

There was more resemblance than the PRR engineer realized. The nose-hung, axle-mounted, direct-current traction motors of the E7's, with their pinion gear driving the axle-mounted bull gear, were directly descended from streetcar designs and shared with them the enormous low-speed torque that a D.C. motor provides.

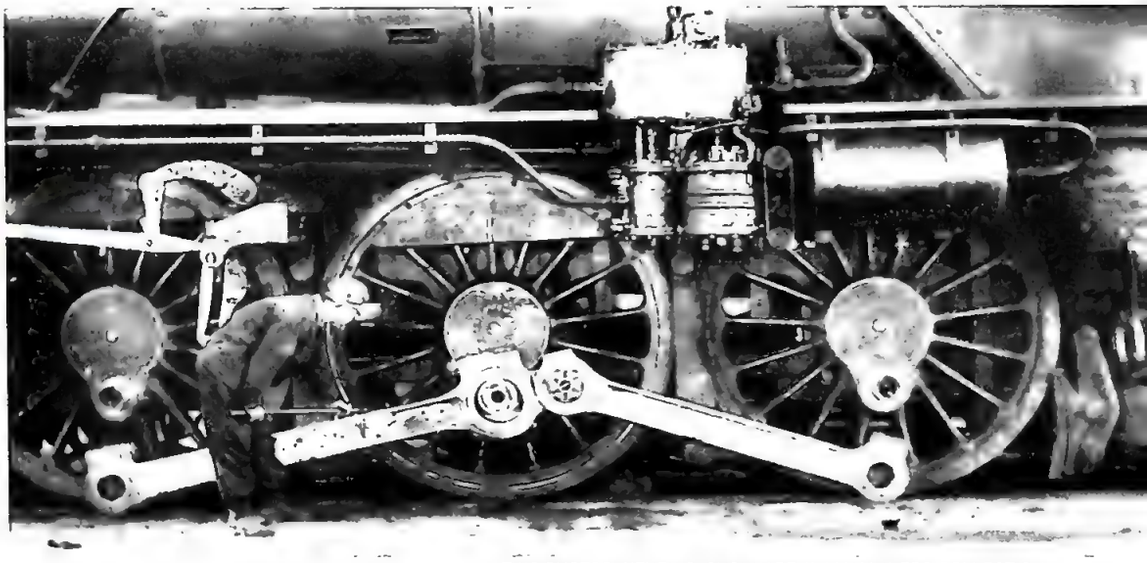
The Pennsylvania Railroad was extraordinarily wary of offending the coal industry, and its choice of Detroit to Baltimore for its first road-diesel assignment may have been partly to reduce the units' visibility, but it was also a good choice for illustrating the advantages of the diesel. Although there were many steam locomotives with long endurance for which the 645-mile run would not have been a serious challenge, PRR did not have any (least of all the troubled new T1 4-4-4-4 duplex-drives). Older steam locomotives without cast frames normally could not handle these distances without developing a need for adjustment of wedges owing to the flexing of the frames. Further, there was the problem of time to clean out the ashpan, normally best done at an engine terminal.

The Crestline, Ohio-based K4's which operated in and out of Detroit were changed at Mansfield, Ohio, with further engine changes at Pittsburgh and Harrisburg, Pa. Baltimore-Washington was handled by electric locomotives, as of course was Harrisburg-New York. Thus these two E7A's replaced at least four steam locomotives, and often more owing to the frequent need to doublehead the



Inside the Crestline roundhouse (left), two workers are seen changing the superheater tubes on an M1 4-8-2. In another view (below), an apprentice appears to be adjusting a wedge on a K4 4-6-2—a routine but labor-intensive task. Many thousands of men were engaged in such work at hundreds of places across the country.

K4's. The implications of this diesel endurance would soon play out across North America with the closing of hundreds of intermediate engine terminals, including big ones like Crestline.



TWO PHOTOS: HENRY C. BURKHART, WILLIAM AYERS COLLECTION

## ENDURANCE

What did this mean? Consider PRR's Crestline engine terminal in 1945, 189 miles west of Pittsburgh and 280 miles east of Chicago. The massive roundhouse, built in 1920, had 30 stalls of 115-foot depth surrounding a 110-foot turntable. It had three drop pits and the unusual feature of a 75-foot, 15-ton-capacity traveling crane able to traverse all 30 stalls, and was able to do Class 3, 4, and 5 repairs (*i.e.*, tasks such as replacement of all flues or renewing all the bushings in the rods and valve gear). Nearby was a coal dock with a capacity of 700 tons. Engine dispatchments during World War II were stated to be 95 to 100 per day, but with almost all mainline passenger trains being doubleheaded and changing engines at Crestline, that has to be an understatement.

With the adjacent, fast, flatland Fort Wayne Division to the west and the modern facilities of the roundhouse combined with the work ethic of its small-town Midwest workforce, Crestline had been the base for PRR's high-speed passenger engine prototypes. These included the S1 6-4-4-6 and poppet-valve-equipped K4s 5399, as well as the two rakish T1 4-4-4-4 prototypes 6110 and 6111. When the T1's proved unable to sustain reliably the intended Harrisburg-Chicago through operation, Crestline became their maintenance base. It also became the maintenance base for the Q2 4-4-6-4 freight duplexes.

Crestline's bread and butter, though, were K4 Pacifics, L1 Mikados, M1 Mountains, and N1 and N2 2-10-2's. The difficult duplexes simply reflected, in spades, the labor-intensive nature of steam. The manpower figures of Crestline roundhouse are not at hand, but there are 63 men in one picture showing the first Q2 to come out of class repairs there. The total force at the time would have been at least twice that number, and that's just the men working in the stalls—the laborers and hostlers outside handling servicing probably equaled the count inside, so perhaps 250 men were at Crestline to keep the steamers on the road.

Several times an hour, pairs of K4's rolled in to the "fresh" side of the house, their first stop being to line up for the ash pit. Every modern roundhouse prided itself on efficient ash handling and usually had extensive machinery to quickly clear the pits and dump the ash into waiting hopper cars. Most often, the fire would be dropped at this time because it was rare to turn a locomotive back to the road without a trip inside the roundhouse to deal with something on the engineer's work report.

Next, the locomotive would be taken by a hostler to the coal dock and a laborer would climb up and fill the tender's coal bunker. Here the sandbox was filled, as well. The laborer had to be there the whole time the coal and sand were going in, so these tasks were taken serially even if the facility was designed to perform both functions without re-spotting the engine. Topping off the water in the tender was another task done serially and almost always required re-spotting, so both the hostler and laborer were involved. Then the engine was moved inside, also a two-man task requiring a hostler to run the engine onto the turntable and the laborer to operate the turntable.

The items on an engineer's work report

JOHN A. REHOR

**One of the diesel's last conquests was the Nickel Plate's high-speed freight operations in the flatlands of the Midwest. Here, 2-8-4 No. 758 flies through Yellow Springs, Ohio, with eastbound reefers in August '56.**

could be any of a wide range of ailments common to steam locomotives, at least one on just about every trip. Steam packing at the piston rods might be leaking, or at the air pump. A lubricator line might be clogged. Valve timing might be off, producing a lame exhaust and reduced performance. Almost always the driving-box wedges would need adjusting. A flue might be leaking, affecting the fire, or a grate bar might be burned from a bare spot that developed in the fire.

Then came the diesels. PRR's E7's and later E8's shuttled tirelessly between Chicago (and Detroit) and Harrisburg, and their freight sibling F3's and F7's with equal imperturbability ping-ponged between Conway Yard west of Pittsburgh and 59th Street Yard in Chicago. Few of them had to head into Crestline for any work. Gone were the hostlers and laborers outside; gone inside were the machinists who turned those replacement rod and valve-gear bushings and fitted them to the pins; gone were the boilermakers who replaced flues and broken staybolts and caulked leaking boiler seams.

At places where a lot of diesels were stationed, ranks of electricians would increase—but not at Crestline, since it never became a major diesel base. Crestline roundhouse remained in service until 1968, but it is unlikely that even 30 employees worked there after 1958. When a diesel came in (almost always from some local job, not the mainline power Crestline had served), a laborer could stick a nozzle in the fuel fill and then go up to fill the sandbox while relying on the automatic shutoff on the fuel hydrant. In fact, at the end, it probably wasn't a laborer but a working foreman who was alone on the shift and did everything—and that was the story at hundreds of formerly large engine terminals across the country. Fewer than 10 percent of the men who had serviced and maintained steam were needed after dieselization.

## STANDARDIZATION

On that September 1945 day in Detroit, the standardization that was possible with diesels was already in evidence. Despite their differing paint schemes and the longer nose slant on the B&O E6, it was externally obvious—and even more so inside—that a PRR E7 and a B&O E6 were practically identical.

In less than two years, E7's were handling almost all the trains at Fort Street Union Depot. B&O forsook the Pere Marquette route at the end of 1945 and instead ran out of Detroit's Michigan Central Terminal for Toledo, with B&O's own power and crews on NYC/MC trackage, but Wabash E7's (and Alco PA1's) took over for the 4-6-2's, while Pere Marquette introduced its eponymous streamliners behind single E7's, which also handled the *Sportsman* of parent Chesapeake & Ohio between Fort Street and Toledo.

The noses facing the late afternoon sun from FSUD's platform shelters had different colors, bright and appealing to the public, but the same I'm-from-La Grange styling. The FSUD 0-6-0's were replaced by two NW5's whose single 12-cylinder, 1,000 h.p. 567B engines were identical to the paired power plants inside the carbody of each 2,000 h.p. E7.

## TRANSFORMATION

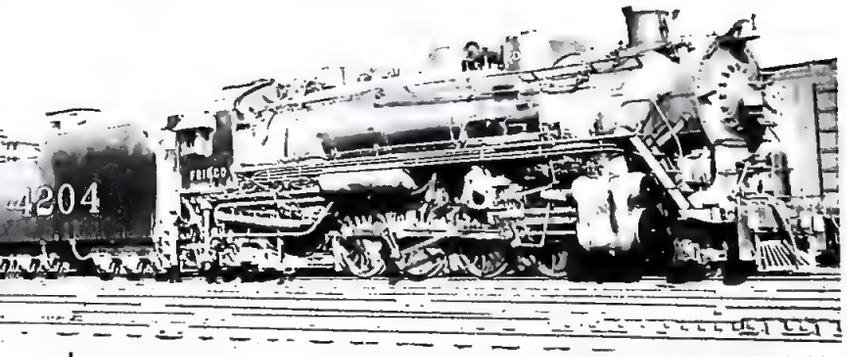
The ways that the diesel changed freight railroading were complex. Where track profiles were rolling or mountainous, the immediate effects were dramatic, owing to that high starting torque of the D.C. motor. Because a steam locomotive's output was mechanically limited by the slow rotation of the driving wheels at starting, which limited the number of piston strokes at low speed, the drawbar force curve of a steam locomotive rose as speed increased, then topped out as cylinder back-pressure and the exhaustion of the boiler's capacity to keep up with the cylinder demands caused the curve to fall again.

The diesel, on the other hand, exhibited its peak tractive effort at starting, limited only by the ability maintain adhesion between wheel and rail, and then fell off

# Steam to diesel on the Frisco

JERRY A. PINKEPANK COLLECTION

**Frisco's 20 4200's were among the mightiest Mikados ever built, but they were easy prey for EMD F3's-F7's and Alco FA's-FB's. The first of 18 A-B-B-A F3's is seen being delivered at St. Louis in January 1948; the road soon standardized on A-B-A sets.**




FRANK E. ARDREY JR.; JERRY A. PINKEPANK COLLECTION

**An example of how** the diesel changed part of one railroad may be found on the rolling profile of the St. Louis-San Francisco, "the Frisco," between Kansas City and Springfield, Mo. The tonnage information comes from SLSF's Northern Division employee timetable for January 30, 1949. The prevailing freight steam power on this district was the 4200-class Mikado, among the most powerful of its type on any railroad, with a rated tractive effort of 68,500 lbs., or 78,100 lbs. with booster, and with the 64-inch drivers, grate area, and heating surface sufficient to easily achieve the 50-mph freight limit for steam on this district. It is telling, however, to note that diesel-powered freights were allowed 55 mph, in recognition of their lack of dynamic augment to their weight on driving wheels, which made them easier on the track.

A 4200 was rated to take 3,450 tons up the 0.7 percent ruling grade out of the Missouri River valley at K.C. to Olathe, Kans., and then 4,000 tons from there to the division point of Fort Scott, Kans. Assuming it got a push from a yard engine for the 0.9 percent ruling grade out of Fort Scott to Edward, the Mikado could then take 3,200 tons across the edge of the Ozarks to Springfield, with short segments of as much as 1.2 percent. Frisco's transportation department had to be thinking in terms of either helping the big Mikado to Olathe or of shuttling tonnage out there to fill, and then reducing at Fort Scott. Or, they could simply let the 3,200-ton limit of the Ash Grove Sub (Fort Scott to Springfield) govern the train for the entire distance. Indeed, in the 1940's and '50's, 3,200 tons was a very respectable train.

But the next day in that transition era, the same train might draw an A-B-A set of F3's, F7's, or Alco FA1/FB1's rated at 5,175 tons for the entire distance. Not only was this enough capacity to eliminate the operation of many second sections of scheduled freight trains and extra trains, but as a practical matter it put a stop almost completely to the fussy work of tonnage clerks in the dispatcher's office and yard offices. Seldom any longer was it necessary to juggle tons from one train to another across a division by shuttling out tonnage or making en route reductions. You can hear the railroaders saying to each other, "Just couple everything but the yard office on 'em and let 'em pull!"

The dispatcher and trainmaster would say this with a smile; the trainmen and enginemen just cut from the extra board would say it with rue.—*Jerry A. Pinkepank*

**In a run-through operation unthinkable in steam days, Burlington and Union Pacific GP9's rolls through Sandwich, Ill., in December 1960 with a Chicago-North Platte freight known as the "GI" for the train's interchange point of Grand Island, Nebr.**

according to the formula 308 x HP/MPH where HP was the rated horsepower for traction (that is, after taking off the portion used to drive auxiliaries) of the prime mover (the diesel engine) and MPH was speed in miles per hour. The rods on a steam locomotive were connected one-quarter turn ahead on one side compared with the other, which prevented stopping on dead center and also divided the piston strokes to evenly spaced quarter turns of the drive wheels. This meant that the smaller the diameter of the drivers, the more frequent the stokes, but also the lower the speed at which the cylinders would exhaust the steam-generating capacity of the boiler and at which the spent steam trying to exhaust from one side of the double-acting piston would fight the live steam coming in one the other side ("back pressure").

A booster could help a steam locomotive with starting. This was a small, fast-acting, geared engine usually driving one of the axles of the trailing truck, but sometimes driving tender axles instead. But boosters were a high-maintenance item, and added only about 10,000 lbs. to the starting tractive effort, less than a 20 percent addition for a large freight locomotive. The end result was that a set of diesel-electrics could usually start a much heavier train than the steam power they replaced. Unless several locomotive units were used, however, the diesel-electrics would not make the same speed across flat districts that modern steam power could.

It was no accident that some of the last significant mainline steam freight operations were in the flatlands of the Midwest. Even then, the fact that the diesel did not have to stop en route for water or coal meant that in a replay of Aesop's fable of the tortoise and the hare, a pair of relentless F3's that topped out with their heavy train at 50 mph could nevertheless arrive in faster time than the 60-mph 4-8-4's they were replacing.

Centralized Traffic Control signaling was spreading over the continent at the same time as dieselization was happening, especially on single-track sections (or causing reduction to single track from double). The two innovations fed off each other. The long trains practical with diesels made old, short, frequent sidings (say, 3,500 feet long) obsolete, and because each CTC control point cost almost as much as a diesel locomotive unit, it was necessary

MAX ZIMMERLEIN; J. DAVID INGLES COLLECTION

to keep the number of them as low as practical. A common standard was to create 10,000- to 12,000-foot sidings about 10 miles apart. As these sidings were installed, the diesels were able to realize their potential to handle longer trains.

## A SIMPLER RAILROAD

Altogether, the railroad—any railroad—became simpler. Water stations and coal docks vanished along with wayside stations that had existed mainly to handle train orders that CTC eliminated. Closely spaced semaphores were replaced by widely spaced searchlight signals, a result of bigger and longer trains with longer stopping distances.

What was not realized at first was that the process begun in the 1940's and 1950's was going to continue. The reciprocating steam locomotive had reached a maximum in size and output. There were some spectacular examples that put most diesel locomotive combinations of the time in the shade. The Allegheny type of the Chesapeake & Ohio and Virginian had a calculated boiler horsepower of 4,500 with cylinder horsepower to match; three-unit F7 sets were required to replace them on trains that were already as big as drawbars of the era would stand. But there was nowhere sensible to go from there with reciprocating steam, because there was no practical way to devise a multiple-unit control.

As steam left the scene, diesels kept growing. By 1961, 2,000 h.p. units were standard; five decades later, 4,000 h.p. units were the norm. And in all cases, they could be assembled in whatever combination was needed, under the control of a single engineer, in combinations routinely totaling 12,000 to 16,000 horsepower. Starting in the 1960's, untended radio remote locomotives had begun to be used, which meant that drawbar force limits (already increased to 500,000 lbs.) were no longer limiting, because the limit could be obviated by the placement of remote units.

Rolling now for BNSF Railway down the old Frisco line between Kansas City, Fort Scott, and Springfield [see sidebar, page 15] are 136-car unit coal trains, the cars each weighing 143 tons under load, with over 20,000 horsepower at front and rear, that need an 8,000-foot siding to meet each other, and crewed by only two people each. Such a progression would have been technically impractical with steam.

What could not be foreseen in the 1940's but is perfectly plain to us today is that dieselization, then seen for its economy, was required to reach the level of performance the railroads needed for survival in the 1970's and beyond. The intensity and relentlessness of 2005 railroading is only possible with the reliability and endurance of the diesel-electric locomotive.

EDWARD THEISINGER

**Diesels and their dynamic brakes cut down on two hallmarks of steam-era freight railroading: coal traffic and brakeshoe smoke, both evident in a May 1952 scene on Western Maryland's Helmstetter's Curve.**

## UNIVERSALITY

Not only was the diesel vastly less maintenance-intensive than steam, diesel fleets when new were routinely posting availability figures above 80 percent, versus the typical 60 percent of even new steam classes. Besides the reduction in the number of maintenance points, and fewer employees at the points retained, this reliability and the distance endurance of diesels meant that another operational change became practical: the motive-power run-through.

A steam locomotive almost never would routinely pass from one railroad to another in a continuous movement, *i.e.*, changing the crew but not changing the locomotive. It did not take long for the railroads to see the potential with diesels. By 1959, mixed consists of black Burlington GP9's and their yellow counterparts from Union Pacific were running between Burlington's Cicero Yard in suburban Chicago and UP's big hump yard at North Platte, Nebr., running through from one railroad to the other at Grand Island, Nebr. Other examples quickly followed. By the early '70's, there was a three-railroad run-through virtually across the continent between Sea-

board Coast Line's Waycross (Ga.) yard and UP's Albina Yard in Portland, Ore., with the Frisco connecting them between Birmingham and Kansas City. All three roads would have locomotives in the same consist. In 1980, SD40-2's of five railroads worked through Alliance, Nebr., on interline unit coal trains. Yet people at Burlington Northern's Alliance shop could deal with them all because of standardization.

Another major change, again most dramatically seen in hilly or mountainous districts, was the use of the dynamic brake, for which there was no equivalent in steam. In steam days, descending a big grade meant stopping at the top while trainmen went along the cars turning up retainers, valves on each car that permitted the engineer to periodically recharge the train line to counter leakage, without releasing the brakes. On longer grades, there would be at least one stop to cool wheels, and heavy trains descended in a cloud of brakeshoe smoke, with a constant risk of setting wayside fires with sparks from the brakeshoes, and with a heavy expense in replacement of brakeshoes afterward.

Today, Cajon Pass, the vital gateway to the Los Angeles Basin used by both BNSF and UP, often sees more than 100 trains per day, plus helper-engine moves, on its two main tracks. Cajon's capacity was less than half that number in the days of steam (and much lighter trains).

## OFF THE COAL STANDARD

The coming of the diesel also meant that transportation of a railroad's own fuel ceased to be a major operational issue. The PRR needed to refill that 700-ton coal dock at Crestline daily. That meant the equivalent of a 100-car coal train every 10 days—for one division point! There were a couple of Lake Erie carferry operations that existed almost exclusively to provide locomotive coal to Canadian Pacific and Pere Marquette in Canada. One can almost understand the mindset of a Grand Trunk Western trainmaster who lamented, when the last fires were dropped on GTW and parent Canadian National locomotives and the solid trains of Kentucky coal stopped coming through the old Monon-GTW connection at Haskells, Ind., "that company coal sure was good business."

With the vanishing of coal as railroad fuel, there also vanished coal smoke and cinders. The "smoke nuisance" was far from a railroads-only phenomenon. The majority of urban homes were still heated with coal, and most manufacturing plants used it as well. Regulations concerning smoke were not sophisticated. City inspectors carried a printed card called a Ringleman Chart which showed various degrees of cross-hatching to represent the ratio of black to white in a smokestack plume, whether from a locomotive or a factory. Fines were levied if the Ringleman number was too high. The chemical content of the smoke was not an issue (although a combination of high-sulphur coal and a confining, wet atmosphere was known to produce acid rain so potent it would make holes in ladies' nylon stockings).

Locomotives were an obvious "spot source" of smoke and were sometimes the target of special campaigns. Both New York and Chicago had laws, or threats of laws, which were the source of many pioneer diesel locomotives being put to work within their limits in the 1920's and after. To the citizen in the street, though, it was the shower of cinders that was the main source of irritation. In an era when most clothing was dried on clotheslines, there were whole swaths adjacent to railroads where the laundry could not be done unless the wind was right. A main appeal of air-conditioning on trains was the elimination of cinders in the hair, eyes, and clothing of passengers. The diesel removed this issue from public discussion.

## A BIG INTANGIBLE

Another item, albeit an intangible one, came with dieselization when it was new: public excitement. Those who knew the engineering achievement represented by a *Hiawatha* Atlantic locomotive were excited by it, but it was the technician's appreciation of a technology being pushed to the edge of its envelope. For the public in the 1930's and '40's, there was magic in the word "Diesel," the big engine that needed no spark plugs or carburetor that powered submarines and 100-mph streamliners.

LINN H. WESTCOTT

**In the late 1940's, Southern Pacific F units climb Santa Susana Pass near Chatsworth, Calif., with a freight out of L.A. Ahead: Miles of seaside running—and decades of rail prosperity, thanks to diesel-electric power.**

Take the colorful livery and effortless speed of the passenger diesel and add the electrifying sight of a slashing figure-8 Mars light cutting the night air, its flash first seen on the horizon like heat lightning on a summer night, and then drawing rapidly closer and exponentially more insistent. No strobe light or alternating ditch lights of today can hold a candle to that for sheer urgency and demand for attention.

"Diesel-powered streamliner" was right up there with "four-motored airliner" as a symbol of up-to-the-minute transportation, and the approach of one of these sleek messengers of modernism made people turn and stop to watch, and in many cases, called for a special trip to the depot just to see the streamliner flash by. In a stroke, dieselization retrieved the image of railroading from that of a smoky, cinder-spewing relic of the 19th century and replaced it with that of a worthy full participant in the bright promise of the future.

Today, in an age grown blasé to technological miracles, the visibility of railroads has diminished, but there is something still there. This is evidenced by the way the people who make television commercials realize the visual impact of modern freight trains. Consider the endless stream of yellow delivery trucks on flatcars that splits a desert grade crossing flanked by startled FedEx and UPS drivers in DHL's recent "I didn't see that coming" campaign. Today's bulky and angular diesels have "heavy duty" written all over them, and when the public does take notice, the instant impression is one of massive, controlled power, easily equal to the task of handling the huge train that follows—one that dwarfs trains of the steam era in height and car-lengths as well as tonnage and overall train length.

I remember in the 1970's seeing a preserved Santa Fe 2900-class 4-8-4, which, as anyone who knew them can attest, is as big a presence as one can imagine in a steam locomotive, sitting next to a string of enclosed auto-rack cars. At that sighting, I realized that modern freight cars make even big steam locomotives seem relatively small. We remember them in the context of 40-foot boxcars that didn't come up to the top deck of the tender, but with today's freight trains, they would be visually upstaged by what they are pulling.

Not so the C44-9's and SD70's of today —their mass and length are fitting to the much bigger task they perform, a transformation of railroading that the diesel made possible. ■

BUILDER PROFILES

# Electro

# -Motive

## From upstart to undisputed champ

When the last fires of revenue American Class 1 steam were dropped in 1960, 7 of every 10 diesels credited with the victory bore the EMD stamp

BY **GREG McDONNELL**

Steam was king, its supremacy uncontested, in 1922 when Harold L. Hamilton and associates rented office space at 17th and Euclid in Cleveland, Ohio, for their fledgling Electro-Motive Engineering Co. Established to design, market, and maintain gas-electric railcars for light-density passenger service, the modest enterprise could hardly be considered a threat to the Big Three locomotive builders, let alone to all of steam locomotion.

Why, the little upstart—its name abbreviated to simply the Electro-Motive Co. soon after its founding—had no factory, no shop, and not even a proprietary product line. EMC was reliant upon suppliers: Winton for most of its gas engines; General Electric for control and electrical systems; and carbuilders such as St. Louis Car and Pullman to assemble its self-propelled "doodlebugs."

Sales of EMC's gas-electric doodlebugs boomed at first, with several hundred cars delivered in the firm's first few years of business. The Depression emptied the order books, though, and but for the intervention of General Motors, little Electro-Motive might have quietly withered away. Instead, GM purchased EMC, along with its major supplier, Winton Engine Co., in 1930.

With General Motors at the wheel, EMC moved beyond distillate and doodlebugs, providing prime movers and expertise in the construction of power cars for lightweight passenger trains, from Union Pacific's bulbous *City* streamliners to Illinois Central's *Green Diamond* and Burlington Route's legendary *Zephyrs*. Meanwhile, Winton, under the tutelage of GM's Charles F. Kettering, set to developing a diesel engine.

The result was the two-cycle, 750-rpm Winton 201, which soon found favor with the U.S. Navy as a lightweight diesel suitable for submarines. In 1934 the Winton was introduced to railroading when an 8-cylinder, 600 h.p. 201A was lowered into the slope-faced, stainless-steel power car of the Edward G. Budd Manufacturing Co.'s original Burlington *Zephyr*. Railroading would never be the same.

With a name honoring the Greek god of the west wind, the articulated three-car *Zephyr* set the world afire. A breathtaking vision of stainless steel and glass, the *Zephyr*, true to its name, could run like the wind. On its inaugural tour, the train dashed from Denver to Chicago without stopping. While the public was seduced by the *Zephyr*'s good looks and speed, her greatest asset was the Winton 201A beneath her shiny skin. The rhythmic chant of a two-cycle Electro-Motive diesel was the sound of the future.

Even the steam builders took notice. It was one thing to build a business around lightweight doodlebugs and marginal back-road passenger operations, but quite another to steal premier passenger trade from the rightful province of Pacifics, Hudsons, and Northerns. The Big Three builders (Alco, Baldwin, and Lima) scowled and pointed fingers at the finite capacity and limited power of the lightweight speedsters. Electro-Motive, of course, had more up its sleeve than pocket streamliners.

Hot on the heels of the *Zephyr*, Electro-Motive boldly took on the steam establishment with Winton-powered diesel-electric locomotives. Still without a factory of its own, the brash newcomer contracted General Electric, St. Louis Car, and Bethlehem Steel to construct nine prototype locomotives in 1935-36.

While Electro-Motive's first locomotives took shape in Erie, Pa.; St. Louis, Mo.; and Bethlehem, Pa., EMC broke ground for its own factory in the Chicago suburb of McCook, Ill. Better known for its mailing address in adjacent La Grange, the 200,000-square-foot plant would soon be celebrated as "the home of the diesel locomotive." At the time, the groundbreaking was little more than local news, but history would prove that the fate of American steam was sealed when a polished steel shovel cut into the cold earth of a farm field next to Route 66 and the Indiana Harbor Belt/B&OCT belt line in McCook on March 27, 1935.

General Electric's Erie works (which also supplied electrical equipment for early EMC's) completed Electro-Motive's first diesels, Lackawanna 600 h.p. end-cab SC switchers 425 and 426, in February and March 1935. Also in March, EMD 518, a 900 h.p., off-center-cab switcher, was built by Bethlehem Steel at Wilmington, Del., and sold shortly thereafter to subsidiary Philadelphia, Bethlehem & New England

Lacking the glamour of the *Zephyr* were EMC's passenger prototypes, 511 and 512. The twin-engined, 1,800 h.p., B-B box-cabs were the brainchild of EMC designer Dick Dilworth, who chose function over form in creating a "four-axle boxcar" designed to match the performance of such steam thoroughbreds as New York

**FT set No. 101 of the Santa Fe, the first customer for EMD's pioneer road-freight diesel, speeds a train west at Willow Springs, Ill., in November 1946.**

C. H. KERRIGAN PHOTO

**E8 No. 811, lettered for GM/ EMD but bearing the livery of future owner Lackawanna, pulls out of Hoboken with DL&W train 11 in early 1951.**

Central's J-1 Hudsons. The two demonstrators were completed at Erie in May 1935, followed by Baltimore & Ohio 50, a nearly identical unit finished in August for service on the *Royal Blue*. St. Louis Car turned out a final pair of passenger box-cabs, Santa Fe 1 and 1A, for the all-Pullman Chicago-Los Angeles *Super Chief*.

The oddball in EMC's early lineup was an 1,800 h.p., twin-engined, articulated-frame center-cab transfer locomotive outshopped by St. Louis Car in May 1936, Illinois Central 9201. It remained a one-of-a-kind but presaged drawbar-connected "TR" duos that IC would commission from EMC a few years later. The ungainly center-cab unit would also mark the end of EMC's dependence on other builders. Even as IC 9201 came together, the erecting floor of the brand-new EMC La Grange plant was crowded with SC switchers . . . and drafting boards stacked with drawings of bigger and better things to come.

Among those things was a sleek, slant-nosed, twin-engined, 1,800 h.p. A1A-A1A passenger diesel that bore no external resemblance to Dilworth's boxy prototypes. B&O signed up for the first production models, designated EA for cabs and EB for boosters.

Possessed of "the most famous face in dieseldom," the Electro-Motive E unit became the standard passenger locomotive of American railroading, and would be such for generations. Evolving from EA to E1 through E9, trading Winton 201A's for successor 567's and shaving its elegant slanted nose to a pug bulldog style, the E unit reigned supreme over American varnish, dethroning the monarchs of steam.

Elegance defined, the E unit was just the beginning. In 1938, EMC introduced a successor to the pioneer Winton 201A, the two-cycle, V-type 567. The engine would power a new line of locomotive models, from the 6-cylinder, 600 h.p. SW1 to the 12-cylinder, 1,000 h.p. NW2 and the twin-V12, 2,000 h.p. E3. A road-freight diesel was the only thing missing from the lineup.

But not for long. Enter the FT, a 1,350 h.p. B-B road locomotive offered singly, in cab and booster versions, or in multiples, from 2,700 h.p. A-A or A-B sets to a 5,400-h.p. A-B-B-A configuration. The FT debuted in November 1939 as EMC 103, an A-B-B-A demonstrator set that embarked on an 11-month, 35-state, 83,764-mile barnstorming tour [pages 102-105] that would sound the death knell for steam.

Spearheading the first wave in the assault on steam, the FT sold 1,096 units to 23 carriers

EDWARD THEISINGER

DAN POPE COLLECTION

J. DAVID INGLES

**Chicago & North Western bought the three EMD GP7 demonstrators, and had a substantial fleet into the 1990's; No. 1558 is at DeKalb, Ill., in December 1957. Burlington Route, an early and loyal Electro-Motive customer, had two EMC NW1's; Winton-engined No. 9201 is south of Chicago Union Station in June 1961.**

by 1945. The FT, wrote TRAINS magazine Editor David P. Morgan, "must be ranked as perhaps the most influential piece of motive power since Stevenson's *Rocket*, for in one stroke, it broke steam's historic monopoly of freight traffic and thereby forecast total dieselization . . ."

General Motors formally merged Electro-Motive and Winton Engine Co. to form its Electro-Motive Division in 1941. No longer "the new kid on the block," EMD was a force to be reckoned with. Packing a full arsenal of ever-improving and more powerful models, EMD catapulted to the top.

By the end of World War II, steam was doomed. Dieselization was no longer a question of if, but when. And La Grange led the way, outselling all the other builders combined.

EMD wasn't perfect. It was uncharacteristically slow, for instance, to respond to the road-switcher, an innovative concept introduced in 1941 by the Alco RS1 and adopted right after the war by Baldwin. After briefly stumbling with the "Branch Line" locomotive, though, La Grange got it right as the 1949 introduction of the GP7, Dick Dilworth's "Ugly Duckling," delivered the *coup de grace* to steam.

After that, there was no stopping Electro-Motive. Production spilled out of La Grange, forcing EMD to establish a second assembly plant in Cleveland [pages 54-63] and a Canadian subsidiary in London, Ontario. By the early 1950's, EMD had steam on the ropes and the Big Three builders playing a life-or-death came of catch-up that left Alco fighting for survival and delivered Baldwin and Lima a knockout punch from which neither would recover.

EMD turned up the heat as the 1,500 h.p. F7/GP7 line gave way to 1,750 h.p. F9/GP9 line in 1954. One by one, the great steam bastions fell—more often than not, to diesels bearing the words ELECTRO-MOTIVE DIVISION on their oval-shaped builder's plates.

The builder would retain its supremacy until 1983, when, after more than two decades of effort, General Electric unseated EMD as the top U.S. locomotive builder. Following years of lukewarm feelings for its La Grange subsidiary, GM finally sold off EMD in 2005.

But when the last fires of revenue American Class 1 steam were dropped in 1960, 7 of every 10 diesels credited with the victory bore the EMD stamp. ■

ABOVE, BALDWIN LOCOMOTIVE WORKS, BELOW, J. C. SEACREST COLLECTION

Brand-new Texas-Mexican 501, the first of seven box-cabs built by BLW subsidiary Whitcomb in 1939, poses at the Rochelle plant. It is painted NdeM cream and brown with a red stripe. On October 30, 1946 (below), twin-unit 601, in Tex-Mex's 1942 Pullman green with gold lettering, and combine 3025 are at the Corpus Christi station. The 600 series indicated two drawbar-connected units as "one locomotive" to satisfy labor, and some units were renumbered over a dozen times as they were swapped out for repairs!

Sixty years ago, the big, visible mark of progress for a railroad was to completely dieselize its operations. More than a half dozen Class 1 line-haul railroads publicly claimed the title in that era. But there are various caveats, usually relating to carrier size, so the subject could use a little light.

First, what was a Class 1? Through 1955—which, incidentally, was the year that saw at least 10 really big railroads finish off steam—just about anyone with a good, solid traffic source and a hundred miles or so of road-haul qualified. All you had to do was "regularly" (five consecutive years, apparently) bring in $1 million in annual railway operating revenue. Effective January 1, 1956, the Interstate Commerce Commission upped the ante to $3 million, but there were still 113 teams in the league. They ranged from former interurban Sacramento Northern, a Western Pacific subsidiary in California that grossed $2.45 million in 1955, to the mighty Pennsylvania Railroad, which took in $935 million.

Near the bottom of the standings, in revenue and in size, was little Texas-Mexican Railway, an obscure freight-only carrier connecting Laredo and Corpus Christi across far south Texas. The "Tex-Mex," with a single 161-mile line, grossed $2.81 million that year to rank above only SN and the Colorado & Wyoming, a Pueblo, Colo., steelmaker's common carrier with three separate lines totaling 40 route-miles.

Let the record show, though, that Tex-Mex was the first U.S. Class 1 railroad to dieselize regular operations, doing so in 1939. That said, there are plenty of caveats to explain why the same claim made later by a few larger, better-known Class 1's has some validity.

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Control of the woebegone Tex-Mex by NdeM passed to the Hanover Bank & Trust Co. of New York, in February 1938, and one R. W. Morrison became president. Dave Keiser was his vice-president, and Keiser was a "great believer" in 0-8-0 steam switchers. The need to reduce operating costs dictated that Tex-Mex go internal-combustion, whereupon seven 71-ton, rigid-frame box-cab diesels of the 0-8-0 wheel arrangement (0-D-0 in

# Just who was first to dieselize?

## Lots of Class 1 contenders, one obscure pioneer

BY **J. DAVID INGLES**

ABOVE, BALDWIN LOCOMOTIVE WORKS, BELOW, J. C. SEACREST COLLECTION

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JESSE M. PATTON

LOUIS A. MARRE COLLECTION

**Some of the Tex-Mex's early diesels lasted more than three decades. In 1961 (top), 502 and 506, showing their 1950's end-cab, hood-unit reconfiguration and wearing TM's green-and-orange scheme (with a Texas Lone Star emblem) introduced on the two F7A's in 1949, are at the Laredo shop; a GP7 and an F are in the background. After World War II, Tex-Mex assembled four box-cabs on its own; the control units (700A and 701A) lasted into the 1960's.**

diesel parlance) were ordered, for $58,000 each, on April 22, 1938, from the Whitcomb Locomotive Works, a Baldwin subsidiary in Rochelle, Ill. (Whitcomb, which produced its first locomotive, a gasoline unit, in 1906, built its first diesel in 1929. Baldwin acquired 92 percent of the firm in 1931 and fully merged it, as a division, in 1940. The factory still stands, incidentally, in other industrial use, and two Whitcomb units are on display in the town.)

Tex-Mex 501-507 were delivered during August-November 1939. They were model 65DE4's, whose De La Vergne engines (the same as were going into Baldwin's fledgling line of switchers) each were rated at 660 h.p. Like Baldwins of the time, 501-507 had Westinghouse electrical equipment. Tex-Mex in 1957 would rebuild four of these seven pioneers into end-cab units with tall hoods, but their machinery remained unchanged. They lasted into the 1960's, painted in the "modern" Tex-Mex green color with orange striping. The last four were retired in 1963.

After World War II, Tex-Mex created four siblings with a (presumably better-riding) 1-D wheel arrangement. It ordered four box-cab carbodies from St. Louis Car Co., with the cast underframes and brake rigging supplied by General Steel Castings, just across the Mississippi River in Granite City, Ill. To power them, Tex-Mex ordered four 1,600 h.p. diesels from Cooper-Bessemer, and the railroad's Laredo shop assembled the quartet. Two were control units and two were boosters, numbered 700A-B and 701A-B; they entered service in November 1946 and May 1948. The B units didn't last long, being retired in 1950 (but were not scrapped until 1964), while the A units ran until 1962 and '63.

Meantime, Tex-Mex saw the light of standardized, off-the-shelf designs, ordering two Baldwin DS-4-4-750 switchers and two EMD F7A's in 1949. Tex-Mex switched to EMD's Geep-*du-jour* in 1950, winding up with 5 GP models in its 11 units purchased through 1971. Here's the kicker for our discussion, though—some steam did remain on Tex-Mex property through the war (the last four locomotives were retired in 1946-47), but apparently steam was used very infrequently after the Whitcombs arrived. The uncertain date of Tex-as-Mexican's last use of steam thus opens the door for other contenders of "first to be dieselized."

## CAST YOUR VOTE HERE

Regardless of when the last steam fire was dropped on Tex-Mex, many would argue that this obscure railroad, with a solitary route across dry territory that required only a few locomotives (18 in 1955), was an anomaly. Beyond Tex-Mex, the first-to-dieselize waters get a bit muddy. In the hectic, decade-long postwar stampede to dump steam, there were other contenders for "first." By the end of 1949, about 11,000 diesels nationwide were handling half the passenger-train-miles, half the yard-locomotive hours, and over one-third of freight gross ton-miles. So generally any Class 1 line-haul railroad whose complete dieselization predates 1950 warrants examination.

With one exception, the candidates beyond Tex-Mex were relatively small pikes. Diesel locomotive builders had only so much capacity, after all, so the bigger the railroad, the longer it took to eliminate steam. As late as August '57, no fewer than 20 Class 1's still operated steam, from giants Santa Fe, B&O, Pennsy, SP, and UP down to specialty carriers such as Missabe Road and Lake Superior & Ishpeming.

Further, we won't try to name all the railroads that "officially dieselized" with public pronouncements, conveniently ignoring a 2-8-2 here or a couple of 2-6-0's there or an 0-6-0 in a faraway yard that still smoked it up in everyday service,

of steam locomotives on the property, had to quietly bring some back into service for a little while to cope with of a traffic surge or a flood.

The exception to "relatively small" is Gulf, Mobile & Ohio, which is generally regarded as the "first major railroad in the U.S." to completely dieselize. The 2700-mile system, newly expanded by half with its 1947 acquisition of the 950-mile Alton, was p.r.-savvy, and was the subject of a two-page spread in *Life* magazine noting its dieselization achievement. This occurred on October 15, 1949, at Columbus, Miss., when 2-8-2 404 tied up on a local freight and was replaced by Alco RS1 1120. (Leave it to the railfan fraternity to get picky—TRAINS, in its March 1950 coverage, noted that GM&O was not "100 percent diesel" as it still operated two gas-electric motor cars, but did grant it status of "100 percent internal combustion.")

What made GM&O a "major" railroad? Well, for one thing, it went from the Gulf of Mexico to Lake Michigan and served eight states. Its mileage made it the 23rd largest Class 1 system, and it dieselized with 231 units replacing 384 steam locomotives, a process that took 14 years and was slowed down by the Alton absorption. In 1947, already controlling Alton matters, GM&O ordered 91 diesels, a large quantity for the time. GM&O official and future president Glen P. Brock in 1943 had estimated that "total dieselization would cost $9 million but save $800,000 to $1

GM&O, which had inherited 33 Alton diesels (plus some EMD F units on order), had dieselized 97 percent of its road freights, 75 percent of its switching jobs, and all but two passenger trains, a mixed in Tennessee and a local in Illinois.

## CONSIDER TWO "MID-MAJORS"

OK, the GM&O was a "major," but was the Chicago, Indianapolis & Louisville? At 541 miles, perhaps—to use today's college-basketball parlance—it was a "mid-major." The term "regional railroad" wouldn't become popular until the Class 1 spinoff craze of the 1980's, but truth to tell, a few dozen of those 113 Class 1's of the 1950's were really what we would come to call "regionals." Moreover, those pikes in the 100-mile range with a dozen or fewer engines could've accurately been called "short lines" . . . though some would've been insulted at that term.

The X-shaped CI&L, known by most as "the Monon" for the Indiana town where

officially rename itself Monon Railroad on January 11, 1956. It ran a small fleet of well-regarded passenger trains, from Indiana's capital of Indianapolis up to Chicago, as well as between Chicago and Louisville, Ky. More significant to this discussion, under the leadership of the legendary John W. Barriger, who became its president in 1946, the Monon achieved complete dieselization three months ahead of the GM&O.

Dieselization wasn't the only major Barriger accomplishment in modernizing the Monon, but the motive-power conversion took only three years to complete. As with a surprising number of finales, Monon's steam curtain dropped on a lowly yard goat, 0-6-0 No. 95, whose last day of work, as the New Albany (Ind.) switcher, was June 28, 1949. The Monon had replaced 74 steam engines (of seven types) with 60 diesels (from three builders).

At least two other Class 1's, both freight-only, dieselized in 1949. Elgin, Joliet &

ABOVE, R. J. FOSTER; BELOW, LOUIS A. MARRE COLLECTION

**Diesel pioneer Gulf, Mobile & Ohio was a good Alco customer. The first of its three DL109 passenger units, crimson-and-silver 270, posed with 4-6-2 567 at East St. Louis in 1940. GM&O adopted Alton's red-and-maroon for its 80 1,500 h.p. freighters of 1946-47, Alco's first and a big order for the era. A set was at Jackson, Tenn., in 1959.**

DICK HOWELL

P. F. JOHNSON

**Monon beat GM&O in dieselizing by three months, but it was one-fifth the size. In fall 1948, two red-and-gray F3's, still carrying a single number (84) and carrying both "The Hoosier Line" slogan and "CI&L" initials, pause with train 6, the Louisville-Chicago *Tippecanoe*, at Crawfordsville, Ind. On January 18, 1948, black-and-yellow RS2 22 has arrived at Michigan City, Ind., from Lafayette.**

Eastern, U.S. Steel's 236-mile "Outer Belt" around Chicago, was one. "The J" had bought its first diesels, four EMC 600 h.p. switchers, in 1936, and by 1944, it had 77 goats from EMD, Alco, and Baldwin and had retired 105 steam locomotives. As on several roads, World War II hindered the J's dieselization efforts, but after the war, 26 Baldwin center-cab transfer diesels, custom-designed for EJ&E (BLW later sold the type to six other roads) and then 10 Alco RS2's finished off steam in October 1949. Twenty-six 2-8-2's were sent north to U.S. Steel sister road Duluth, Missabe & Iron Range.

The other 1949 contender was in Pennsylvania anthracite country, the 178-mile Lehigh & New England, which in 1948-49 received from Alco 32 units: 10 FA's, 3 FB's, 6 S2's, and finally 13 RS2's. By December 1949 L&NE proclaimed itself fully dieselized, having quenched steam fires on 42 locomotives of five wheel arrangements, a few of which were Camelbacks.

## THE 1948 ENVELOPE, PLEASE

Another, perhaps more well-known road that was almost exactly the Monon's size in mileage dropped its last steam fires in mid-1948 about a year before CI&L did—the legendary New York, Ontario & Western. Fondly known as the "O&W" and fittingly as the "Old Woman" or "Old & Weary," the beleaguered railroad dieselized out of dire economic necessity. The O&W was on an irreversible slide to oblivion, and ran its last train on March 29, 1957, becoming the largest U.S. railroad up to that time to be shut down in entirety. At the end, the Old Woman had 46 diesels, all EMD NW2 switchers (21) or F units (25) since it had sold its first diesels —five 1941-42 GE 44-tonners—in 1950-51.

Two Class 1's that were really short-line in culture also dieselized in 1948, with products from different builders. Each operated a single route, and both would drop to Class 2 status in 1956. One was the 262-mile Detroit & Mackinac (say it Mackinaw), which ran along northeastern lower Michigan's Lake Huron shore. The other was the 168-mile Columbus & Greenville across northern Mississippi.

Both had notable diesels. D&M in November 1946 had accepted five Alco RS2's (plus an S1 switcher), and in early 1948 it received a sixth RS2 to finish off steam. D&M's first two RS2's were Alco's first such 1,500 h.p. B-B units, and were among the builder's first "full-size" (vs. the 1,000 h.p. RS1) road-switchers. Basically tied for time of introduction with the D&M RS2's were A1A-A1A-trucked 1,500 h.p. Baldwins for the Columbus & Greenville and similar Alco RSC2's for the Milwaukee Road.

When C&G's five pioneering Baldwin road-switchers (later designated as DRS-6-4-1500) of 1946 were joined in 1948 by two ex-Army 65-ton Whitcomb center-cab switchers, the road was nominally dieselized, but it kept 4-6-0 No. 178 around, overhauling it in 1948, and C&G's actual last steam run didn't occur until 1951. In 1947 alone, though, C&G had cut its fuel bill by $45,000, not exactly pocket change on a road whose 1948 gross income was $1.97 million, its best since 1929.

## ALCOS OVER HERE AND THERE

The stories of early dieselizations would not be complete without telling a bit of the tale of the Alco RS1, which figured large in dieselizing more than one road before the Monon, including a couple of the smaller Class 1's. Legend has it that the idea for this model, the first "true road-switcher," was conceived on the back of an envelope in the Chicago office of Rock Island President John Farrington in the summer of 1940. He ordered two at a point when Alco had built only 14 "conventional" end-cab/low-hood switchers (*i.e.*, S1's and S2's). A few more RS1 orders followed, but World War II intervened.

When the U.S. Army took over the operation of part of the Trans-Iranian Railway in 1943, the desert climate and the topography dictated diesel replacements for the 2-8-2's on hand. So, while it was having Alco build 44 six-motor versions of the RS1 for the Iranian line, the Army in 1942 requisitioned all 13 existing multiple-unit-equipped domestic B-B versions, and had Alco refit them for shipment overseas [see "Army Alcos in War and Peace," March and April 1980 TRAINS]. Rock Island gave up 4, Milwaukee Road 2, U.S. Steel's Tennessee Coal & Iron 2, Atlanta & St. Andrews Bay 3, and New York, Susquehanna & Western 2. All but TC&I had new RS1 replacements from Alco by mid-1943; the steel-plant road was content to wait until fall 1946. The RS1 model would remain in production for 19 years.

Two of those "volunteers," the Bay Line and the Susquehanna, to use their popular monikers, are on our first-to-dieselize candidates list, but again, at 82 and 120 miles, respectively, were not in the same league as the GM&O, Monon, or Ontario & Western. A&StAB, which in recent times has dropped its full name to be "The Bay Line," was, in fact, like the Rock Island, involved in the RS1's creation.

About the same time RI's Farrington was huddling with Alco, J. A. Streyer, president of the Bay Line—a single-line pike linking its headquarters town, the Gulf of Mexico port of Panama City, Fla., with the Seaboard Air Line at Cottondale and Atlantic Coast Line and Central of Georgia at Dothan, Ala.—approached Alco with a similar request. Streyer needed a road unit capable of operating in multiple so as to be able to eliminate helper engines for A&StAB's 1.5 percent, 13-mile grade at Ridgetop, Fla. Upon learning of the Rock Island-requested design, he joined Far-

rington in ordering two, which arrived in March 1941. The Bay Line got a third one in January 1942 (and two S2 switchers the following November) before the military swooped in.

After getting two new RS1's and the promised three replacements in April 1943, the Bay Line dieselized its freight operations by adding another RS1 in 1944, two more in '45, and a ninth in '47 (it would get a 10th in 1950). The railroad didn't completely dieselize, though, until mid-1947, when it received a "streamlined unit," F3A 1501, from "the EMD outfit" (to quote Streyer) in June for its lone passenger train, a heavily marketed run (for Gulf fishermen and vacationers) to Dothan, which exchanged through Atlanta cars with the Central of Georgia. After 1950, the Bay Line returned to EMD, getting two GP7's and three SD9's, but that lone F3 acquisition means that A&StAB, which experienced growth and remained in the Class 1 ranks into the mid-1950's, dieselized ahead of all the other aforementioned Class 1's save the Tex-Mex.

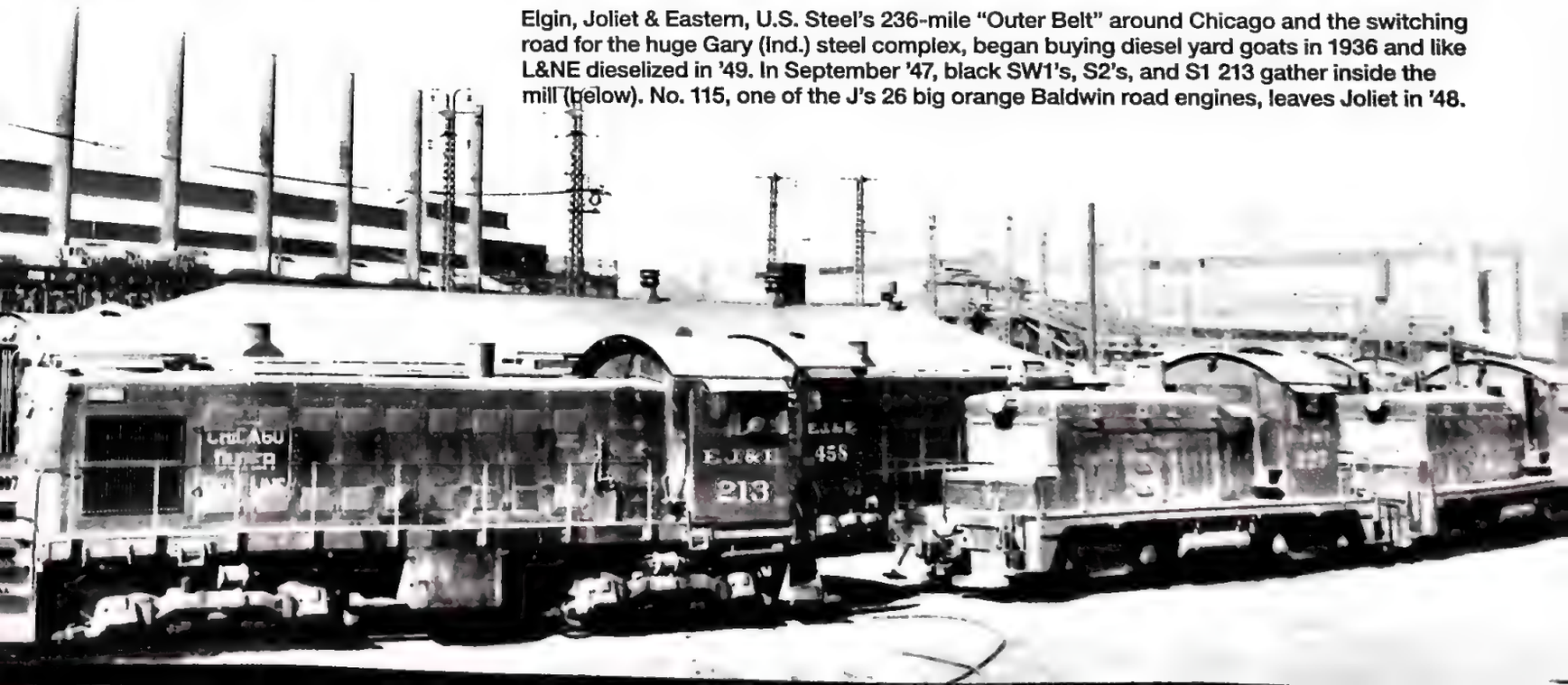
The Susquehanna, or "Susie-Q" as many called it, might have been too small to be a "regional" or "mid-major," but it ran commuter trains and operated in northern New Jersey, just offstage from New York City's bright lights. Freed from 40 years of Erie Railroad control in 1940 and trying to emerge from bankruptcy (it would do so in 1953), Susquehanna—like GM&O an early believer in motorized passenger trains—by 1945 boasted that 90 percent of its trains were powered by internal-combustion. During 1941-45 NYS&W acquired 12 multiple-unit-equipped RS1's (including the requisitioned pair) and would get 6 more after the war. (Interestingly, the road assigned m.u.-equipped units even num-bers; those without m.u. had odd numbers.) Its last two

ALCO-GE

**A 4,500 h.p. A-B-A trio of black-and-white Alco freight units (later labeled FA1's and FB1's), rolls a train on Lehigh & New England, a 178-mile anthracite hauler and Pennsylvania-New Jersey-New York bridge line that dieselized in '49 with 10 FA's, 3 FB's, 6 S2's, and 12 RS2's.**

ABOVE, RICHARD K. SMITH; BELOW, C. P. FOX

**Elgin, Joliet & Eastern, U.S. Steel's 236-mile "Outer Belt" around Chicago and the switching road for the huge Gary (Ind.) steel complex, began buying diesel yard goats in 1936 and like L&NE dieselized in '49. In September '47, black SW1's, S2's, and S1 213 gather inside the mill (below). No. 115, one of the J's 26 big orange Baldwin road engines, leaves Joliet in '48.**



MICHAEL CAPUTO

Three of Susquehanna's six S2's, plus RS1 232 (1 of 16) pose at Little Ferry, N.J., in '46. Susie-Q's colors were silver and maroon.

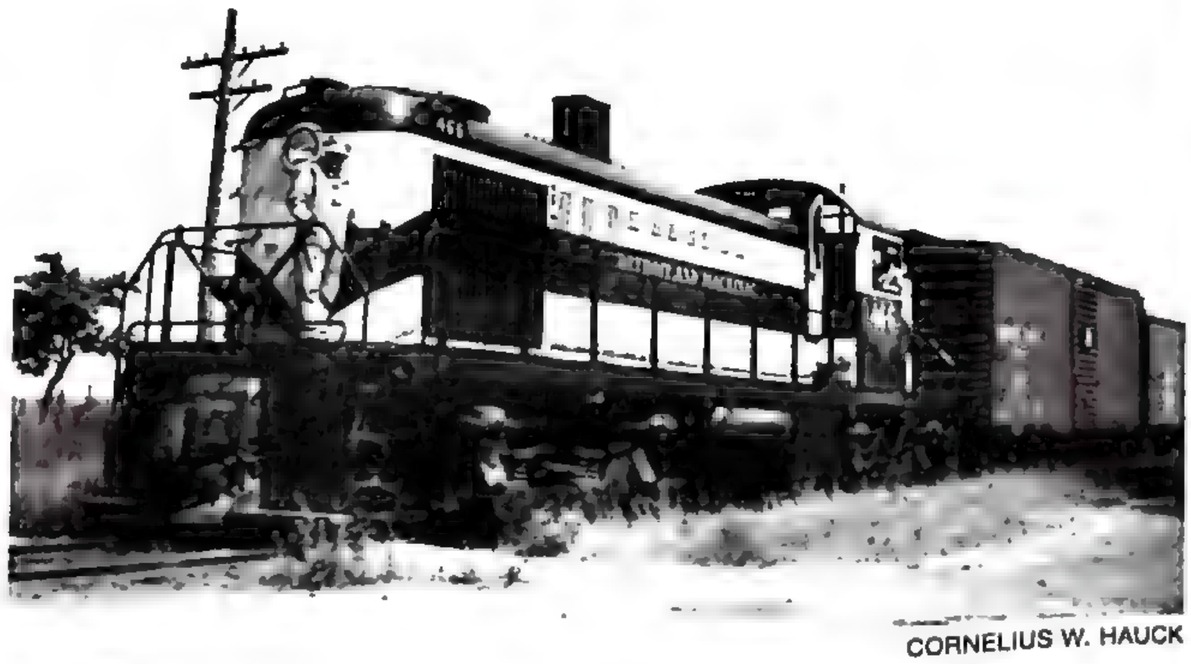
steam engines were in standby status by late 1945, but an upturn in business kept it from fully dieselizing, and in 1947 it had to lease two steam locomotives each from Erie and L&NE. Susie-Q finally dropped steam forever in 1948.

## RS1'S ON THE S.I. AND THE LOUIE

Another obscure Class 1 that the RS1 dieselized was Spokane International, which had a single 151-mile line from its namesake eastern Washington city north to the border at Eastport, Idaho, and a Canadian Pacific connection. SI replaced 13 steam locomotives with nine RS1's in late 1949, but didn't run its last steam engine until early 1950. The railroad said that with the RS1's, it more than halved its $300,000 annual outlays in locomotive and enginehouse expenditures. SI added three more RS1's in 1953, and the road was acquired by Union Pacific in 1958.

Finally, you can't say "RS1" without thinking of the Minneapolis & St. Louis, a.k.a. "M and Saint L" or "the Louie." Bigger than the Monon and O&W combined, M&StL spread 1,400 miles from Minneapolis south to Des Moines, Iowa, and Peoria, Ill., and west into South Dakota. Its 35 RS1's comprised the largest U.S. fleet, were operated in twos and threes on road freights (even after M&StL also got sets of EMD F units), and were well-known for sporting nine different color schemes and, until a system renumbering in 1956, road numbers keyed to their dates of delivery. The Louie bought 13 RS1's from 1944 through early 1946, and spread further purchases out until getting its last 3 in 1951. But M&StL misses our serious consideration on dieselizing because it still had 38 steam locomotives in 1949 and didn't drop the last fire until January 1951. M&StL thus is in company of a couple of neighboring small Class 1's that also might come to mind as candidates, but which did not dieselize until 1950 or after: the Duluth, South Shore & Atlantic and the Minneapolis, Northfield & Southern.

BALDWIN LOCOMOTIVE WORKS



CORNELIUS W. HAUCK

Mississippi's 168-mile Columbus & Greenville and Michigan's 262-mile Detroit & Mackinac each largely dieselized in late 1946 with pioneer 1,500 h.p. road-switchers. D&M's RS2 466 (at Tawas City in July '47 (above right), was Alco's first "full-size" road-switcher. Green C&G Baldwin 601 (at Columbus, left, with a newly applied orange stripe), on A1A trucks, beat 466 into service by two months.

## The unofficial ballot

Class 1's: Who dieselized when

| Railroad | Mileage | Year |
|---|---|---|
| Bay Line | 82 | 1945* |
| CI&L (Monon) | 541 | 1949 |
| C&G | 168 | 1948* |
| D&M | 262 | 1948 |
| DSS&A | 554 | 1951 |
| EJ&E | 236 | 1949 |
| GM&O | 2,757 | 1949 |
| L&NE | 178 | 1949 |
| MKT (Katy) | 3,241 | 1952 |
| M&StL | 1397 | 1951 |
| MN&S | 77 | 1950 |
| NYO&W | 541 | 1948 |
| NYS&W | 120 | 1945* |
| SLSF (Frisco) | 4,979 | 1952 |
| Southern | 7,625 | 1953 |
| Spokane Int'l | 151 | 1950 |
| Tex-Mex | 161 | 1939* |

*Token steam operation later

So, the debate of "who was the first Class 1 to dieselize" does not have a concrete resolution. Strictly speaking, the gold medal goes to Texas-Mexican, and the silver to the Bay Line. Beyond that, let's just award ribbons to the small Class 1's that accomplished it before 1950. Gulf, Mobile & Ohio gets a bigger ribbon, and for the record, the next systems larger than GM&O to finish off steam were the 4,979-mile SLSF (Frisco) and 3,241-mile Missouri-Kansas-Texas (Katy), both in 1952, with giant (7,625-mile) Southern Railway doing so in 1953. ■

ROBERT R. MALINOSKI

On June 25, 1946, two years before the beleaguered New York, Ontario & Western dieselized, two of its nine A-B FT sets, 804 and 601, decked out in the road's gray-orange-and-yellow scheme, leave Middletown, N.Y., with 44-car train BC-3. The 541-mile line quit in 1957.

ABOVE, M. B. COOKE; BELOW, J. N. "JIMMIE" JONES

Blue-and-silver RS1's lead a Bay Line freight. When green-and-yellow F3 1501, pictured on train 4 at Panama City, arrived in 1947, the pike was finally all-diesel.

# Alco

BY **GREG McDONNELL**

Alco should have known better. The largest of the Big Three steam builders, the American Locomotive Company was the first to embrace the diesel. It was first to catalog a line of standardized diesel-electric locomotives: 60- and 100-ton box-cabs with General Electric electrical equipment and Ingersoll-Rand diesels. It was first, again with GE and I-R, to build a commercially successful diesel-electric locomotive: Central Railroad of New Jersey 1000, a 60-ton, 300 h.p. box-cab put to work in the Bronx in 1925. It was first to have a diesel prime mover of its own, a feat accomplished with the purchase of engine builder McIntosh & Seymour of Auburn, N.Y., in 1929. It was first with the road-switcher, the RS1 of 1941.

Nevertheless, Alco underestimated the diesel and lost its early lead to upstart Electro-Motive. Things may have been different had the Depression not evaporated funds that might otherwise have been directed to diesel development, and had the War Production Board not stifled diesel production and design work during World War II.

Still, it was Alco's own decision—despite its early involvement with the diesel—to stick with the steam standard, subscribing at first to the common belief that the diesel's place was only within yard limits and in territory governed by smoke-abatement laws. No one in his right mind would contend that the diesel could ever compete with the likes of Schenectady's finest: Milwaukee *Hiawatha* 4-4-2's; New York Central Hudsons, Mohawks, and Niagaras; Union Pacific Challengers and Big Boys.

None of which is to imply that Alco sat on its laurels while H. L. Hamilton, Boss Kettering, Dick Dilworth, and associates plotted to beat the nation's biggest locomotive builders at their own game. Alco led the way in the development and perfection of the diesel switcher and even dabbled in road and passenger diesels, along with tri-power diesel-battery-electrics for New York Central as early as 1928. Indeed, NYC 1550, a 750 h.p. Ingersoll-Rand-powered 2-D-2 freight box-cab completed by Alco in October 1928, is considered the first successful road diesel in the U.S.

By 1932, Alco was building a standardized line of high-hood, end-cab diesel switchers powered by 600 h.p. McIntosh & Seymour 531-series engines and outfitted with customer-specified General Electric or Westinghouse electrical equipment. Otto Kuhler restyled the design in 1934, and Alco added a turbocharged 1,000 h.p. version to the lineup in 1937. Two years later, Alco unveiled what became the S-series switcher, with a low-profile hood, GE electricals, and a 539 engine available in 660 h.p. normally aspirated and 1,000 h.p. turbocharged versions.

The quintessential yard engines, the S1, 2, 3, and 4, with their nearly indestructible 539 and rugged GE electrical gear, ravaged the ranks of steam in yard, transfer, and local service. One of Alco's most successful diesel designs, the S's gave even Electro-Motive a run for its money.

Beyond yard limits, the tables were turned. Not even Alco could ignore the sleek, slant-nosed EMC E's that were stealing not only the spotlight, but serious business in the passenger trade. Forced to play catch-up, Alco followed EMC's lead, commissioning Otto Kuhler to design a striking streamlined carbody for its

Great grilled hope: Launched with great fanfare in 1946, the PA was ultimately a disappointment for Alco, though few ever questioned its aesthetics.

Notched hood corners and long noses characterized Alco's big road-switchers. Nickel Plate 328, at Toledo, Ohio, in 1966, is an 1,800 h.p. RSD12.

J. DAVID INGLES

# Tougher than the rest

The only steam builder to survive the transition to diesel put up a good fight

DAN POPE COLLECTION

EMIL ALBRECHT

Union Pacific FA1 1607 leads an FB1 and an EMD F3B on a freight in Utah's Echo Canyon in June 1950. UP had 44 FA1's and 44 FB1's, all built 1947-48.

BARNEY L. STONE PHOTO, KRAMBLES-PETERSON ARCHIVE

D&H, on-line to the Schenectady plant, dieselized entirely with Alco switchers and RS's. Here, RS2 4015 leaves Lake George, N.Y., for Fort Edward.

2,000 h.p., twin-engined passenger diesel that debuted in January 1940 with Rock Island DL103b 624.

The DL was a work in progress that evolved externally and internally with nearly every order. Turbocharged 538-series diesels in RI 624 gave way to 539's in subsequent models from DL105 to 109 and 110. A mere 78 were built during 1940-45, with New Haven's 60 DL109's accounting for the lion's share. Wartime restrictions were partially to blame, but the DL's were no match for Electro-Motive's E units.

In 1940, Alco partnered with Schenectady neighbor General Electric, already its exclusive supplier of electrical gear, to jointly market diesels under the Alco-GE name. The partnership was a logical extension of a relationship that traced back to 1906 when the two collaborated on construction of electric locomotives for New York Central's Manhattan electrification. The marriage would last until the companies parted ways in 1953, but Alco would continue to purchase GE electrical equipment for all its diesels.

Alco might have lagged behind in the passenger-diesel trade, but it beat everyone to the punch with one of the most innovative designs of dieseldom: the road-switcher. The simple genius of the RS1 design involved placing the machinery of a 1,000 h.p. S2 switcher on an elongated frame, adding a short hood to accommodate an optional steam generator for passenger

ROBERT SPRAGUE PHOTO, J. DAVID INGLES COLLECTION

**Alco's top seller was the S2 switcher; 1,502 units went to customers in the U.S., Canada, and Mexico. NYC 8569 is at West Springfield, Mass., in '62.**

service, and placing the whole works on road trucks in lieu of the S2's rough-riding Blunt trucks.

The RS1 was an immediate success. Indeed, the first 13 built were drafted for the war effort, outfitted with six-axle trucks, given close-clearance cabs, and shipped for duty overseas. The military ordered 144 similarly outfitted units, and once those orders were filled, production of domestic RS1's resumed in 1943, not to cease until 1960, long after successor models had been introduced.

Meanwhile, Alco and the other builders had been blindsided by the phenomenal performance of Electro-Motive's FT. Alco had nothing to compete with the revolutionary road freighter, and wartime restrictions hobbled its efforts to respond. It would take Alco until well after VJ Day to fire a return salvo.

By 1946, Alco had a new engine, the four-stroke, V-type 244, and a catalog of passenger and freight road locomotives to go with it. Housed in a distinctive flat-nosed, GE-designed carbody, the 1,500 h.p. B-B-trucked road-freight cab and booster units, which came to be known as FA's and FB's (all model designations for early Alcos were latter-day creations), and their A1A-A1A big brothers, the 2,000 h.p. PA1/PB1 passenger locomotives, were created in direct response to EMD's popular E and F units. Less glamorous, but like nothing in EMD's showroom, was the RS2 road-switcher (along with an A1A-A1A version, the RSC2).

In that passenger-conscious era, the PA was Alco's great grilled hope, packing a V16 244 that achieved with one engine the 2,000 h.p. rating that required two 567's in the competition's vaunted E unit. Alas, the 244 was afflicted with mechanical flaws, including a weak crankshaft, that made it a less than stellar performer. Alco ultimately remedied most of the 244's ills, but its reputation never fully recovered, and the problems put the first serious chink in Alco's armor. Nevertheless, Alco managed to garner 42 percent of the diesel market in 1947, when orders were running at flood tide.

As convinced as some at Alco might have been of the diesel's superiority, the company did not give up easily on steam. As late as 1946, steam accounted for three-quarters of Alco's locomotive production. Its 100th year in the locomotive building business also was when it completed its last steam locomotive, a Pittsburgh & Lake Erie 2-8-4, on June 16, 1948.

A tough competitor, Alco fought tooth-and-nail against EMD's seemingly unstoppable market domination, adding the C-C RSD4 and RSD5 to its arsenal in 1951-52 and replacing the troubled 244 with the new 251 engine and an all-new model line in 1956.

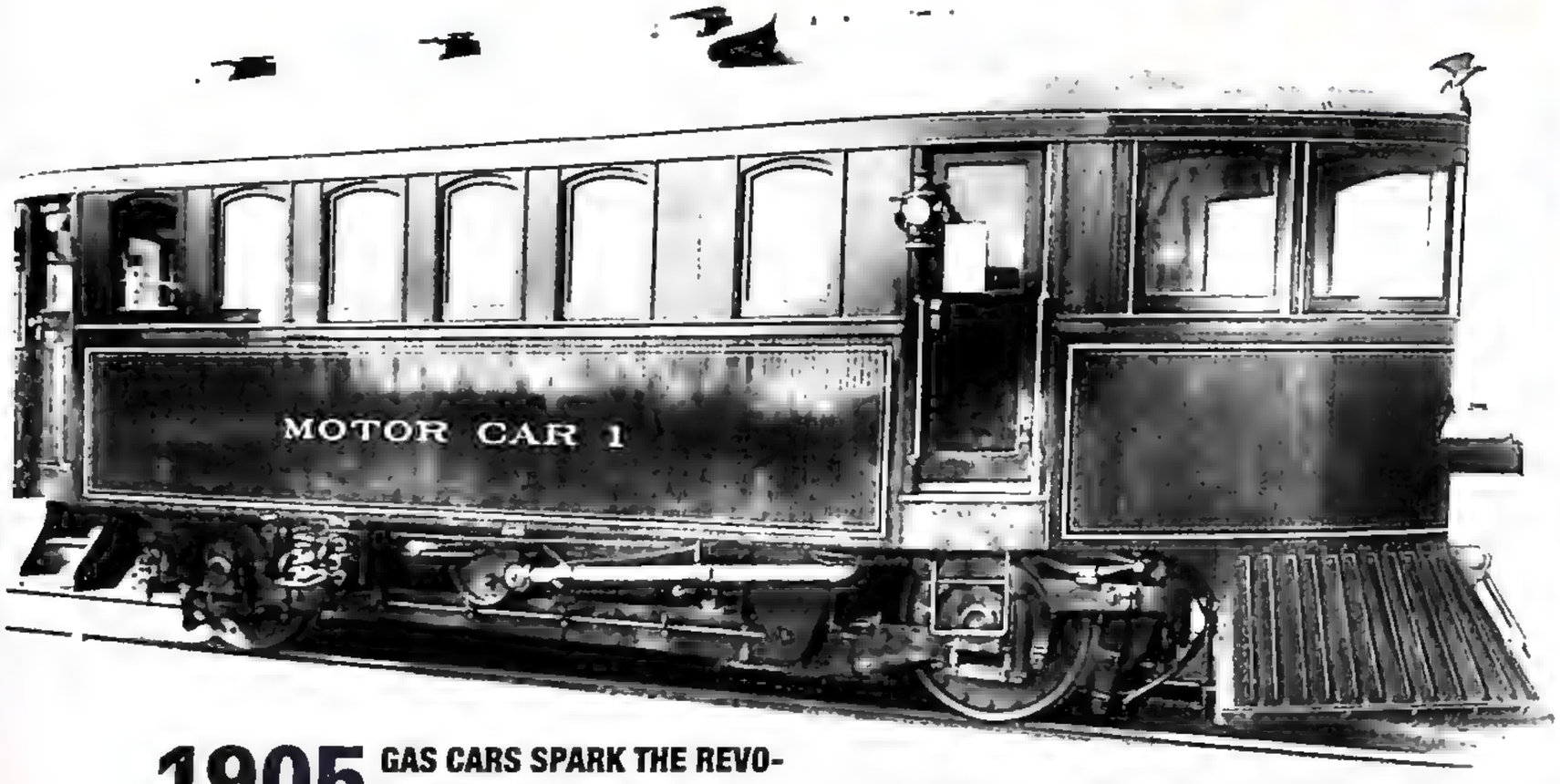
Of the Big Three steam builders, only Alco managed to survive the transition to the diesel. By the end of 1956, Lima was long gone, Baldwin had built its last big diesel, and the American Locomotive Company had formally become Alco Products. It was a humbled Alco, though, that duked it out with EMD as dieselization hit the home stretch in the late 1950's. Despite another model line, the Century series of 1963, Alco still ran a distant second. Some said Alco didn't follow up in the field with trouble-shooting like EMD did; some ascribed EMD's dominance to being part of General Motors. Both were factors, undoubtedly among others, but regardless, Alco could not beat Electro-Motive.

As steam diminished and the diesel market tightened, only the strongest would survive, and that was EMD. Alco, a tough competitor to the end, finally threw in the towel, exiting the new-locomotive market in 1969, although its Canadian affiliate, Montreal Locomotive Works, would carry on into the 1990's. ■

# Timeline to victory

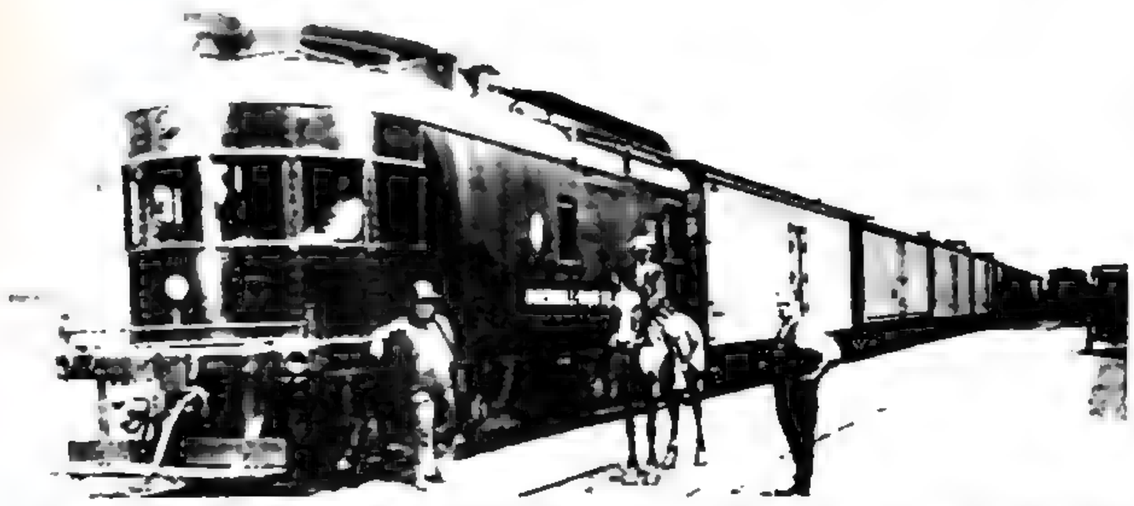
## Six decades of landmark events in the battle of steam vs. diesel

BY **GREG McDONNELL**

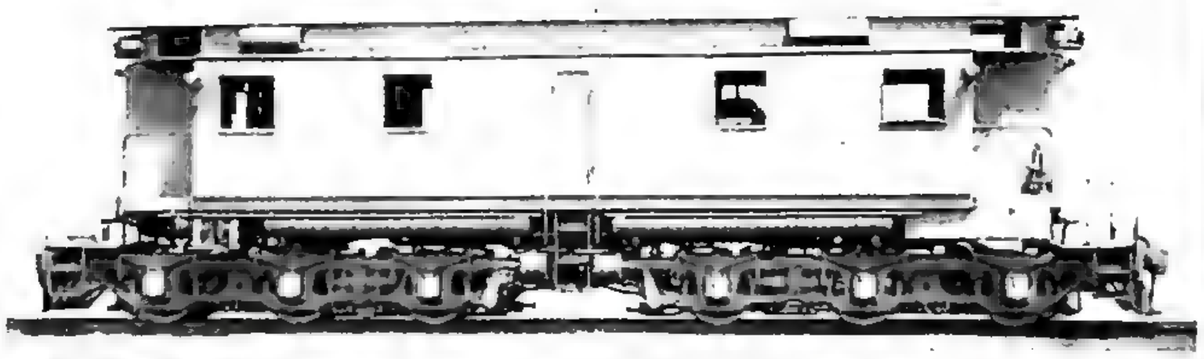



**1905 GAS CARS SPARK THE REVOLUTION:** Union Pacific's William R. McKeen spearheads development of a gasoline-powered, mechanically driven railcar. The "McKeen Car" is the first successful use of internal-combustion power on North American railroads. Prototype car M-1 makes its first run, Omaha-Valley, Nebr., and back, on March 7; some 150 McKeens are sold to 35 roads. UNION PACIFIC

**1922 ENTER ELECTRO-MOTIVE:** Harold Hamilton, Paul Turner, and others establish the Electro-Motive Engineering Corp. in Cleveland, Ohio, to market gas-electric railcars. Outfitted with GE electricals, Winton engines, and carbodies from various builders, more than 700 EMC doodlebugs are sold by 1930. R. S. McGONIGAL



**1923 THE DIESEL HITS THE ROAD:** In December, the first GE/Ingersoll-Rand diesel-electric box-cab tests at I-R's plant in Phillipsburg, N.J. Numbered 8835, the locomotive embarks on 13-month tour in 1924. It hauls a passenger train Jersey City-Harrisburg, Pa., making 8835 the first diesel-electric to be used in U.S. road service. GENERAL ELECTRIC



**1925 BALDWIN BUILDS ITS FIRST:** In June, Baldwin completes its first diesel locomotive, 1,000 h.p. A1A+A1A-trucked box-cab 58501. Powered by a Knudsen Motor Corp. V-12 and equipped with Westinghouse electrical gear, the 58501 tests throughout summer and fall on the Reading Co., but fails to meet expectations. It is returned to Eddystone, serves as Baldwin's plant switcher, and is scrapped in 1941. BALDWIN

**1905 DAWN OF THE DIESEL:** International Power Co. in April outfits an Alco box-cab carbody with GE electrical equipment and two 4-cylinder diesel engines built by the Corliss Steam Engine Co. to create an experimental locomotive for Southern Pacific. This is thought to be the first diesel locomotive built.

**1906 GE GETS THE BUG:** GE builds its first gas-electric railcar, or "doodlebug," Delaware & Hudson 1000, a baggage-coach powered by a 140 h.p., 6-cylinder Wolsley engine from Britain. The car operates in test and regular service on D&H for several months.

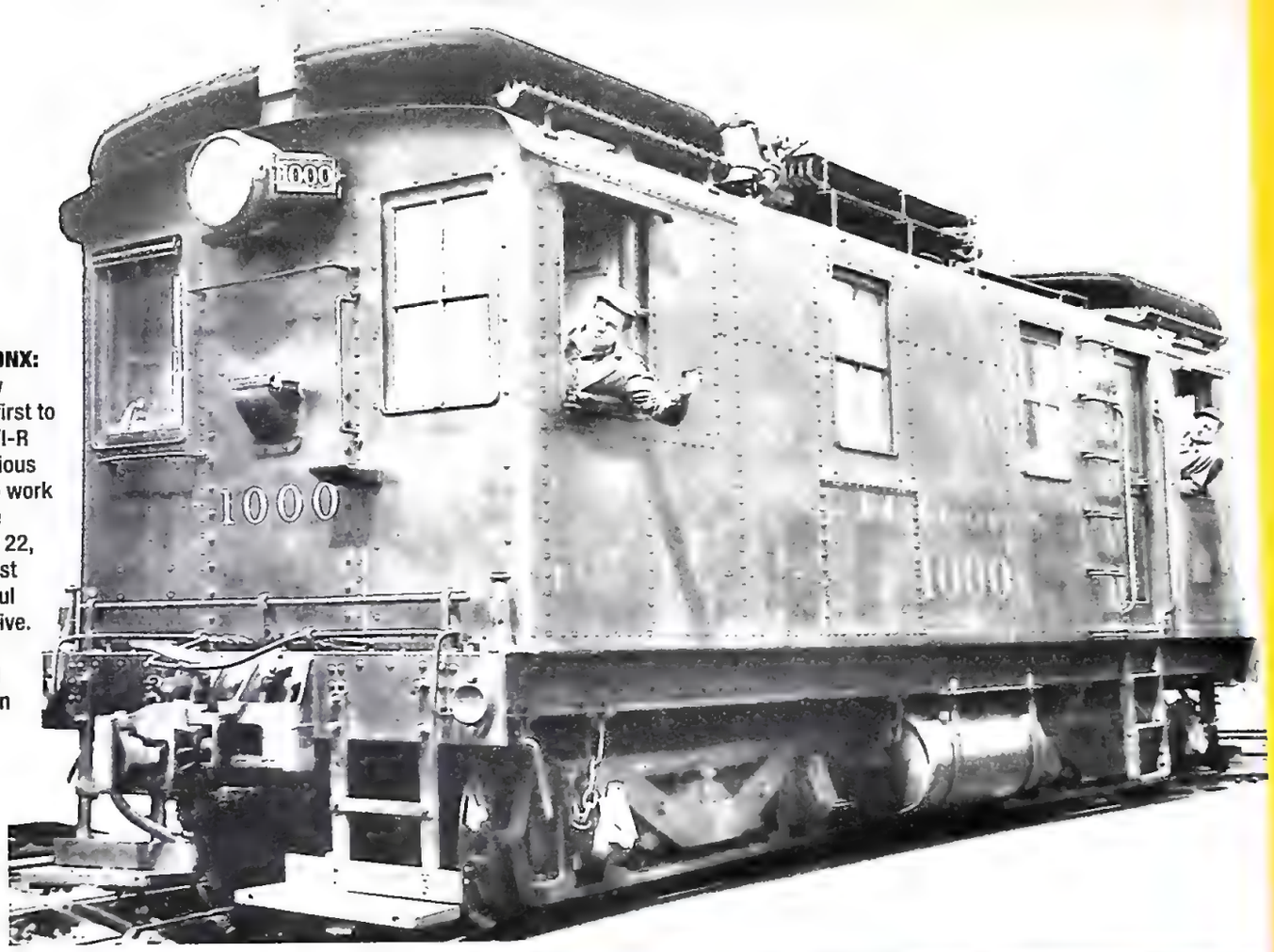
**1914 HARNESSING THE POWER:** GE's Lemp control system, named for inventor Hermann Lemp [pages 46-48], is patented. Tested in gas-electric GE plant switcher *Bumble Bee* and perfected by 1922, this is a key achievement in the development of practical gas-electric cars and diesel-electric locomotives.

**1917 GE'S OWN DIESEL:** GE tests its 200 h.p., twin-cylinder GM-50 diesel engine in the carbody of GE motor car No. 4 on March 8. In fall 1918, GE completes three GM-50-powered steeple-cabs for Jay Street Connecting, City of Baltimore, and the U.S. Army.

**1924 ALCO/GE/I-R GET IT RIGHT:** The consortium of Alco, GE, and Ingersoll-Rand produces North America's first standardized diesel locomotive models, five 300 h.p. box-cabs built as stock; one becomes CNJ 1000.

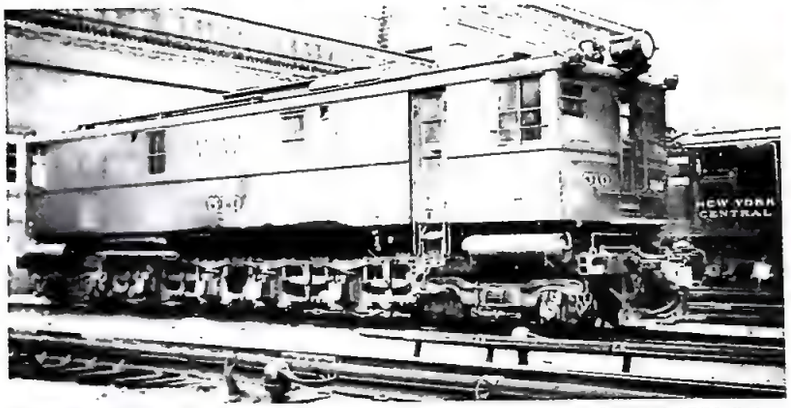
**1925 CLASS 1 LOCOMOTIVE COUNT:** 1 diesel, 63,612 steam

**1925 NO SMOKING:** New York City bans the operation of steam locomotives within its city limits. Chicago soon follows suit with restrictions on steam operation within its downtown area.




**1925**

**HOME RUN IN THE BRONX:** Central Railroad of New Jersey No. 1000—the first to be sold of five Alco/GE/I-R box-cabs built the previous year as stock—goes to work at a carfloat yard in the Bronx, N.Y., on October 22, becoming America's first commercially successful diesel-electric locomotive. It stays on the job until 1957, when it is retired to the B&O's museum in Baltimore. CNJ




**1928** **ROADWORTHY:** Alco completes New York Central 1550 (later renumbered 510), a 750 h.p. Ingersoll-Rand-powered 2-D-2 freight box-cab in October for service in the New York area. This locomotive is considered the first successful road diesel in the U.S. HAROLD L. GOLDSMITH

**1929** **MOTOR CARS TO LOCOMOTIVES:** Following a 1927 installation of Winton gas engines in two former mail cars, Rock Island converts three more to locomotive-baggage cars and orders 7 all-new units from EMC with bodies by St. Louis Car. J. DAVID INGLES COLL.

**1925** **TRANSCONTINENTAL TRIUMPH:** Canadian National railcar 15820 completes a 2,937-mile Montreal-Vancouver trip in 67 hours, arriving on the Pacific coast November 4. The car averages 44 mph overall and reaches speeds of 60 mph; its 185 h.p. Beardmore diesel is never once shut down [see pages 82-87].

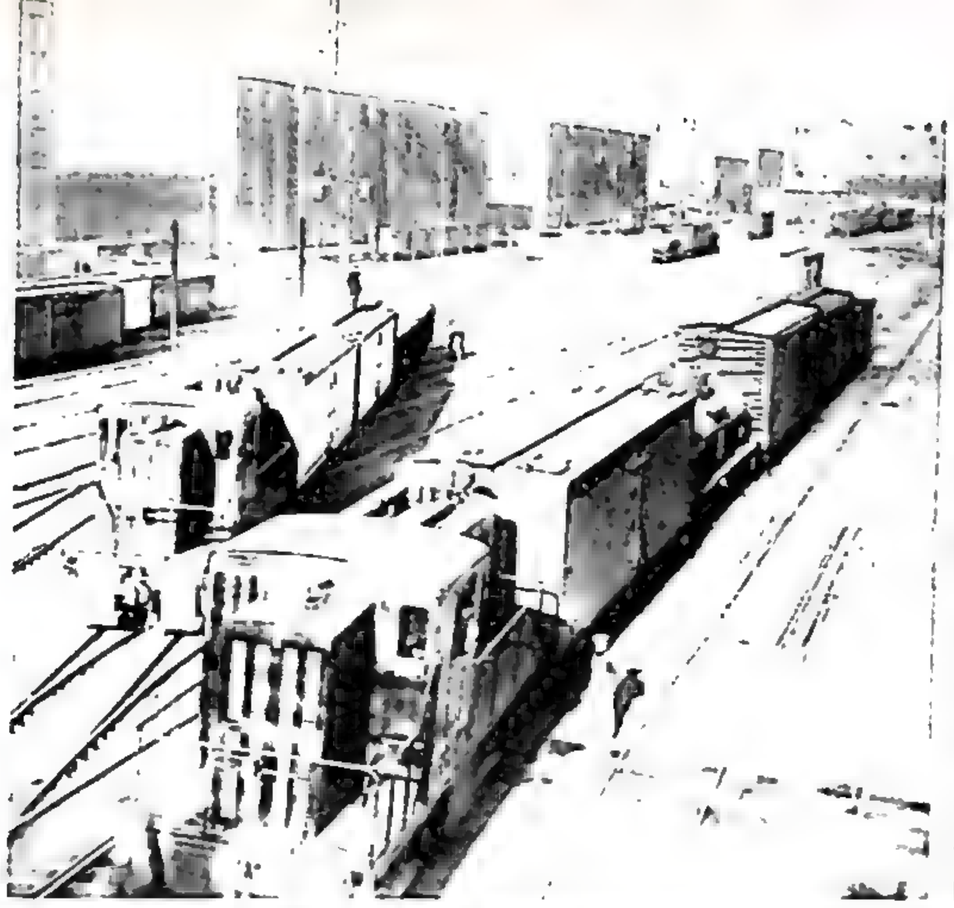
**1925** **LONG ISLAND-BOUND:** Long Island Rail Road 401, an Alco/GE/I-R box-cab built at GE's Erie, Pa., plant (as were the rest of her kin), departs December 15 under her own power for delivery via the Pennsylvania Railroad to the carfloat slips at Greenville, N.J.

**1928** **WESTINGHOUSE WEIGHS IN:** Having acquired U.S. sales and production rights for the diesel engine designs of the William Beardmore Co. of Glasgow, Scotland, in 1926, Westinghouse completes its first diesel locomotive, an articulated two-unit, 600 h.p., box-cab delivered as Long Island 403A and 403B.

**1929** **MAKING IT BIG:** CN 9000, a two-unit Canadian Locomotive Co.-Westinghouse locomotive powered by 1,330 h.p. Beardmores, makes its first run on the Montreal-Toronto *International Limited* on August 26. This is the first large road diesel in North America.

**1929** **EDDYSTONE TRIES AGAIN:** Baldwin's second diesel-electric locomotive, a 1,000 h.p. B-B "oil-electric" box-cab switcher numbered 61000, is outshopped in May and dispatched from Baldwin's Eddystone, Pa., plant on a demonstration tour covering at least seven Class 1 roads and lasting until 1931. The Depression derails further development.

**1930** **DETROIT GOES RAILROADING:** General Motors purchases Electro-Motive Co. and its gas-engine supplier, Winton Engine Co. GM backing fuels the development of a Winton diesel and the growth of EMC.



## 1931

**SWITCHERS IN BROOKLYN:** GE builds seven Ingersoll-Rand-powered, all-welded, hood-type switchers for Bush Terminal in Brooklyn, N.Y. The carbody design and configuration of the 300 h.p., 60-ton units—internally similar to CNJ 1000—foreshadow the road-switcher, still a decade away. GE PHOTO, KEVIN HOLLAND COLLECTION

**1933-34** **DEPRESSION DIESELS:** For two Depression years, Alco does not deliver a single steam locomotive. But during the same period, the Schenectady plant turns out nine "high-hood" switchers powered by 531-series engines: demonstrator 602 and eight units for the Lackawanna. LOUIS A. MARRE COLLECTION

**1934** **THE DIESEL GOES MAIN-LINE:** In April, two months after UP's M-10000 streamliner debuts with a Winton distillate engine, GM unveils its first diesel-locomotive power plant, the Winton 201A, in Burlington Route's *Zephyr*. America's first high-speed, diesel-powered train makes a record run from Denver to Chicago in 13 hours 5 minutes, on May 26, pulling the diesel out of the shadows of yard duty and into the spotlight. CB&Q

**1930** **SHAPE OF THINGS TO COME:** CN receives CLC-Westinghouse switcher 7700. The first "visibility cab" locomotive, it heralds a trend that will lead to the standard switcher design and, ultimately, the road-switcher.

**1930** **CLASS 1 LOCOMOTIVE COUNT:** 74 diesel, 55,875 steam

**1931** **A DIESEL BUILDER FOR BALDWIN:** Baldwin purchases I. P. Morris & De La Vergne, Inc., whose experience with diesel engines is a key element of the Baldwin plan to design and build a line of diesel locomotives.

**1931** **FIRST STANDARD SWITCHER:** Alco outshops 600 h.p. switcher No. 600 for demonstration on the New Haven, which numbers it 0900. Powered by the new 531-series engine from McIntosh & Seymour (which Alco bought in 1929), it is the first full-size locomotive with the hood-type, end-cab switcher layout. It is also Alco's first solo foray into the diesel field.

**1935** **DIESELS FOR THE SUPER:** Santa Fe takes delivery in August of St. Louis Car-EMC box-cabs 1 and 1A for use on the all-Pullman *Super Chief*, which enters service behind 1 and 1A at Chicago on May 12, 1936.

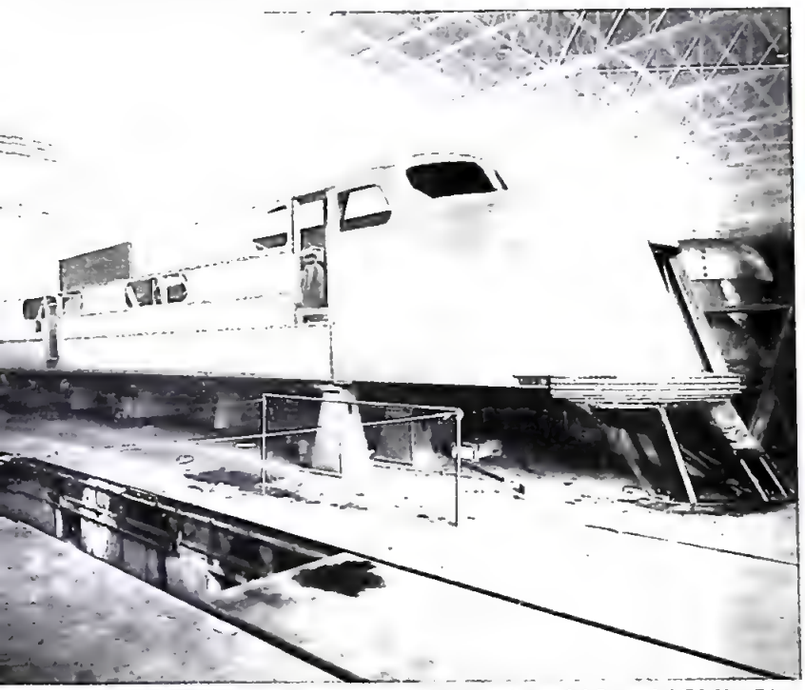
**1935** **CLASS 1 LOCOMOTIVE COUNT:** 113 diesel, 45,614 steam

**1936** **HOME OF THE DIESEL LOCOMOTIVE:** EMC opens a 200,000-square-foot assembly plant in the Chicago suburb of McCook, Ill. Better known by its La Grange mailing address, the plant completes its first locomotive, Santa Fe SC switcher 2301, in May.

**1936** **ALCO UPS THE ANTE:** Alco beefs up its 531 engine, adding a turbocharger—the first applied to a railroad diesel—to boost horsepower from 600 to 900.

**1935 ELECTRO-MOTIVE'S LOCOMOTIVES:** EMC's first true diesel locomotives are outshopped from General Electric's Erie plant: two 600 h.p. switchers for the Lackawanna (Nos. 425-426) and three twin-engined, 1,800 h.p. passenger box-cabs: EMC demonstrators 511 and 512 and Baltimore & Ohio 50 (above, now preserved at the Museum of Transportation near St. Louis). All are powered by GM's new Winton 201A diesel engine and equipped with GE electrical gear. J. DAVID INGLES

**1936 UNVEILING THE VO:** Baldwin outshops its first end-cab diesel switcher, demonstrator No. 62000, in the fall. The first locomotive powered by the 660 h.p. De La Vergne VO engine, the unit is later sold to the Santa Fe as No. 2200. Three 900 h.p. versions are delivered to New Orleans Public Belt in December 1937. BALDWIN



**1937 A STAR IS BORN:** EMC completes B&O model EA No. 51, launching a long line of streamlined, twin-engined units that will dominate the passenger-locomotive market for decades and evolve over 1,314 units from the slant-nosed, 1,800 h.p. Winton-engined EA to the bulldog-nosed 2,400 h.p. 567-powered E9. ELECTRO-MOTIVE

**1939 GOING SOLO:** Rock Island commissions Davenport Locomotive Works to construct a 44-ton diesel switcher whose size and weight allows one-man operation under the "90,000-pound" rule of the 1937 National Diesel Agreement with the railroad unions. Other small builders, like Whitcomb, a Baldwin subsidiary, offer similar models (that's Milwaukee Road Whitcomb 993 at Wabasha, Minn.), but GE's 44-tonner, introduced in 1940, enjoys the most success, selling to industrial, shortline, and Class 1 customers worldwide. J. A. PINKEPANK; J. D. INGLES COLLECTION

**1937 EXIT INGERSOLL-RAND:** Diesel pioneer Ingersoll-Rand leaves the locomotive business.

**1937 SWITCHERS AND STREAMLINERS FOR THE ROCK:** Chicago, Rock Island & Pacific, an early user of internal-combustion power, embraces the diesel with orders for two types of Winton-engined Electro-Motive B-B units: 600 h.p. switchers and six 1,200 h.p. model TA cab units that look like pocket-sized EA's for its new Budd-built *Rocket* streamliners [see "The Rock's Camelot," STREAMLINER PIONEERS 2005].

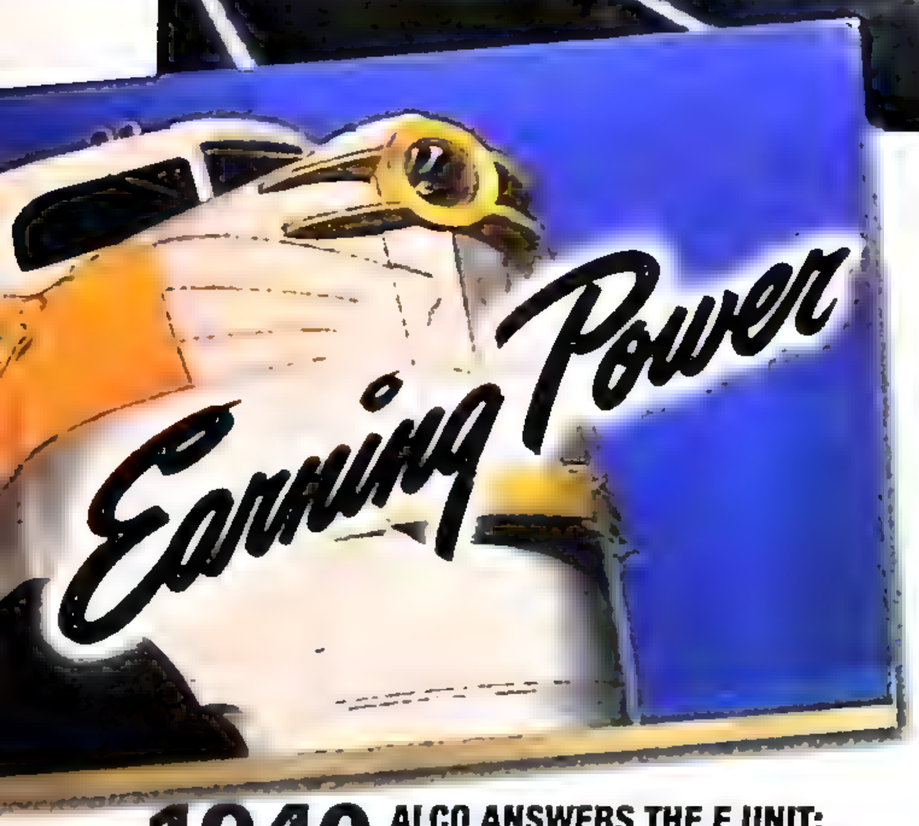
**1938 MORE MUSCLE FOR ELECTRO-MOTIVE:** EMC introduces its 567 engine, the prime mover that, in 6-, 12-, and 16-cylinder versions, will quickly propel the builder to the top position in North America and be EMD's standard for a quarter-century. EMD also begins production of its own electrical equipment, based on designs previously supplied by GE.

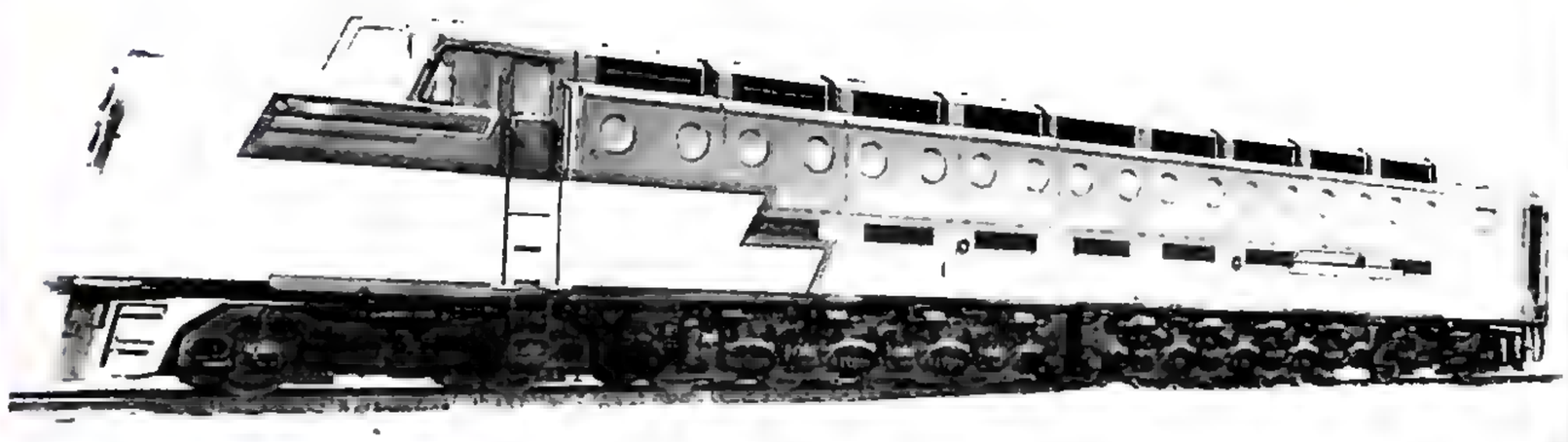
**1939 ALCO BEEFS UP:** The Schenectady builder unveils the McIntosh & Seymour 539 engine, an in-line 6-cylinder diesel available in 660 h.p. normally aspirated and 1,000 h.p. turbocharged versions.

**1939 EDDYSTONE ENHANCES ITS ENGINE:** Baldwin introduces a redesigned VO engine and switcher line with VO660 demonstrator 299. The design will sire VO660 and VO1000 lines as well as DS and S models that will be Baldwin standards.

**1939 FM ENTERS THE FRAY:** The first railroad application of Fairbanks-Morse's opposed-piston diesel engine, developed for U.S. Navy submarines, enters service in August, as power plants in six St. Louis Car Co. railcars for Southern Railway (Nos. 1-4) and subsidiary Alabama Great Southern (40-41).

**1939** **NO LOOKING BACK:** Electro-Motive FT No. 103—a 5,400 h.p., A-B-B-A demo set seen here at Denver on April 28, 1940—departs La Grange in November on an 83,764-mile, 35-state tour that will change railroading forever by showing that diesels can handle heavy-haul freight service [see pages 102-105]. RICHARD H. KINDIG



**1940** **ALCO ANSWERS THE E UNIT:** Alco introduces its first standard road diesel, the twin-engined, 2,000 h.p., Otto Kuhler-styled DL109. Rock Island gets the first, New Haven the most. The first true dual-service diesels, New Haven's 60 DL109's work passenger trains by day and freights by night. Schenectady, N.Y., neighbors American Locomotive Co. and General Electric partner to market Alco-built diesels with GE electricals under the "Alco-GE" brand.

**1943** **EDDYSTONE THINKS BIG:** Baldwin tests prototype locomotive No. 6000 on a 32-mile run over the B&O from Eddystone to Elsmere Jct., on June 16. Begun in 1941 but delayed by World War II, the immense cab unit is powered by four of an intended *eight* crossways-mounted 750 h.p. De La Vergne 408-series V8 diesels and has a 2-D+D-2 wheel arrangement more in line with electric-locomotive practice. Designed for passenger service, the giant proves unsatisfactory, but its running gear is later used for Seaboard Air Line DR12-8-3000 No. 4500; SAL will get 14 total "Centipedes," National of Mexico 14, and Pennsy 24. BALDWIN

**1939** **FIRST ALL-DIESEL CLASS 1:** Texas-Mexican, a 161-mile Corpus Christi-Laredo line, in November receives the last of seven "0-8-0" 660 h.p. box-cabs from Baldwin with De La Vergne VO engines and Westinghouse electricals, to completely dieselize—the first Class 1 railroad to do so [see pages 24-31].

**1940** **CLASS 1 LOCOMOTIVE COUNT:** 797 diesel, 40,041 steam

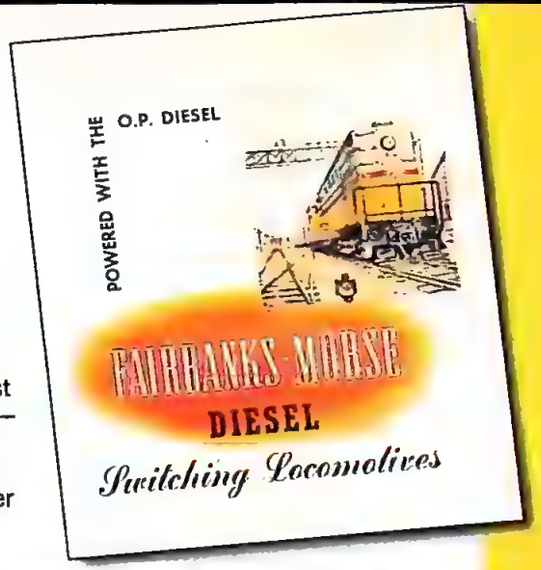
**1941** **SUITED FOR THE DESERT:** Santa Fe FT A-B-B-A set No. 100, first FT in revenue service, hits the road February 4.

**1941** **PERFECT RECORD:** B&O EA 56 and EB 56x complete their 365th consecutive trip on the Washington-Chicago *Capitol Limited* on February 25, achieving 100 percent availability and logging more than 280,000 miles.

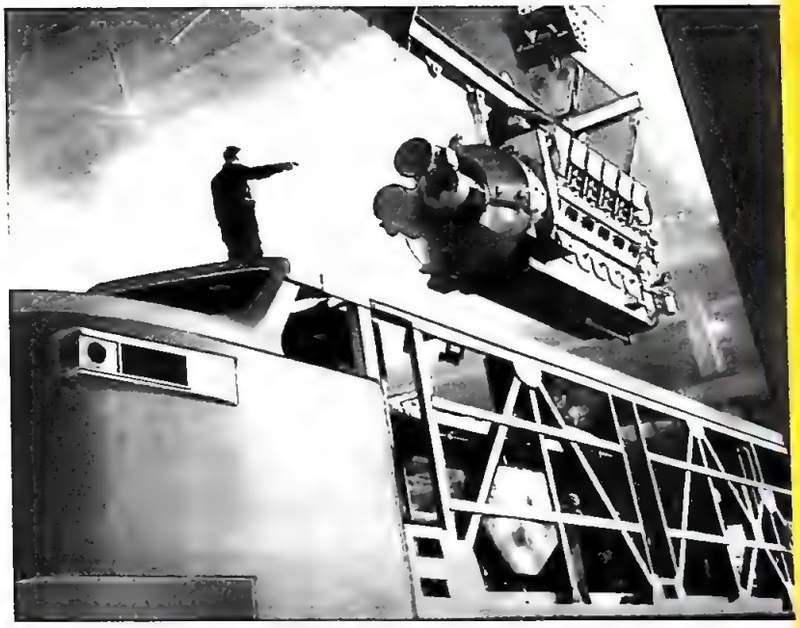
**1941** **DRAFTED YOUNG:** Alco elongates the frame of the 1,000 h.p. S2 switcher, adds a short hood for a steam generator behind the cab, puts the locomotive on road trucks, and the RS1, granddaddy of all road-switchers, is born. The first, Rock Island 746-749, along with those sold to several other roads, are drafted by the U.S. Army and dispatched overseas.

**1945** **ERIE-BUILT:** The first of FM's Loewy-styled A1A-A1A "Erie-built" cabs emerge in December from GE's northwest Pennsylvania plant as a Union Pacific A-B-A set. A total of 82 Erie-built cabs and 29 boosters will come from the GE facility before expansion of FM's Beloit, Wis., plant in 1948 allows the builder to construct all its locomotives there.

**1945** **BIRTH OF A BEST-SELLER:** As the war winds down, EMD introduces the E7 and F3. Best-selling of all E's, the E7 will total 510 units, while sales of 1,807 F3's will pave the way for the even better-selling F7.




**1944 ANOTHER BUILDER:** Fairbanks-Morse goes from supplier to builder on August 8 when its first locomotive—Milwaukee Road 1,000 h.p. switcher No. 1802—breaks through a ceremonial banner at FM's Beloit, Wis., plant.



**1946 ALCO FIGHTS BACK:** In January, Alco delivers to Gulf, Mobile & Ohio the first production units powered by its new 12-cylinder, 1,500 h.p. 244 power plant. In the streamlined freight locomotives that will later be labeled FA (for cabs) and FB (boosters), Alco finally has an answer to EMD's F unit. A 16-cylinder, 2,000 h.p. passenger version (the PA and PB) follows in September, amid publicity that includes designation of the first set, Santa Fe A-B-A No. 51, as the builder's 75,000th locomotive. Crankshaft, turbocharger, manifold, and other infirmities plague early examples of the 244; most bugs are remedied, but not before Alco's reputation is sullied and its market-share diminished. ALCO

**1945 BRIEF FLING FOR BLACK MARIA:** Alco obtains War Production Board permission to finish a 241-powered prototype, an A-B-A test-bed cab-unit trio numbered 1500-ABC and dubbed "Black Maria." The precursor of the FA, the 1500 runs on NYC, D&H, and New Haven (above, at New Bedford, Mass.), but is scrapped in September 1947. NORTON D. CLARK

**1945 CLASS 1 LOCOMOTIVE COUNT:** 3,816 diesel, 38,853 steam

**1946 EDDYSTONE SCORES:** Baldwin beats RS1 innovator Alco to the the first higher-horsepower, and also the first 6-axle, road-switcher as Columbus & Greenville DRS-6-4-1500 No. 601 enters service October 8, weeks ahead of Alco's first 1,500 h.p. RS2's and RSC2's.

**1947 LIMA GIVES IN:** In October, steam stalwart Lima merges with General Machinery of Hamilton, Ohio, to form Lima-Hamilton and enter the diesel-locomotive business.

**1947 PENNSY SPENDS BIG:** The Pennsylvania, America's largest railroad and, until recently, a strong advocate of advanced steam designs, signals its motive-power future with diesel orders totaling $15 million.

**1947 RARE MISSTEP AT LA GRANGE:** EMD stumbles in responding to Alco's new road-switcher design with BL1 demonstrator 499, a semi-streamlined 1,500 h.p. B-B, aptly described by TRAINS Magazine editor David P. Morgan as looking "like a cross between a cab unit and a Borden milk car." Only 58 more (designated BL2) will be built, for nine customers.

**1948 BACK TO CLEVELAND:** With the postwar diesel boom at full tilt and La Grange booked beyond its capacity, EMD returns to the place of its birth, opening a plant in Cleveland, Ohio, to assemble switch engines . . . and soon, Geeps [see pages 54-63].

**1948 ALCO ABANDONS STEAM:** The American Locomotive Co. delivers its last steam locomotive, Pittsburgh & Lake Erie 2-8-4 9401, on June 16. The end of steam production is coincident with Alco's 100th year of building locomotives. In 1946, 75 percent of the builder's production was still steam.

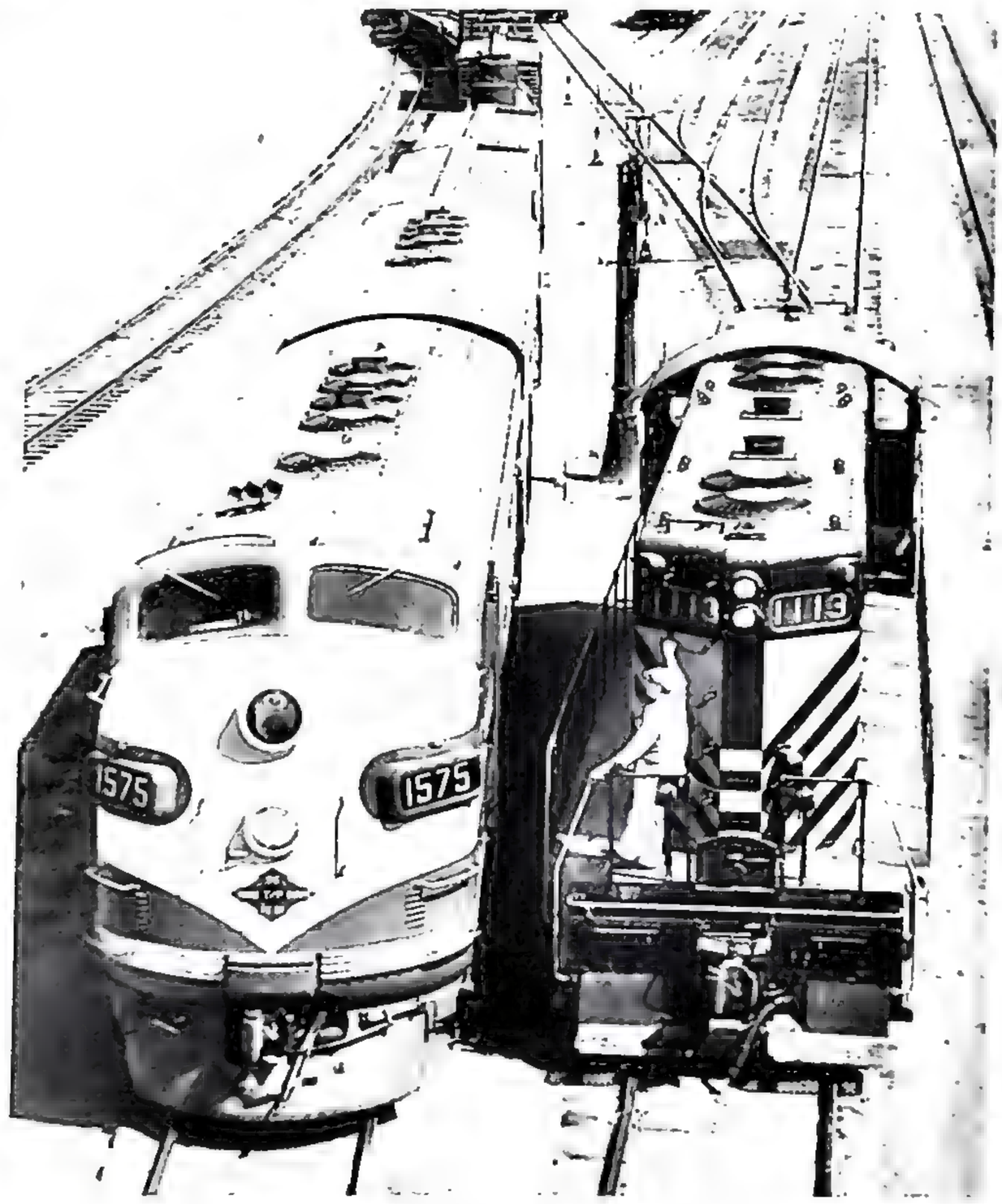
**1949** **LIMA-COME-LATELY:** Lima-Hamilton on May 12 completes its first diesel locomotive, a 1,000 h.p. switcher to demonstrate as No. 1000 (sister 1001 is seen at the plant with a disassembled mining shovel loaded on several flatcars). One day later, Lima delivers its last steam locomotive, Nickel Plate 2-8-4 Berkshire No. 779. LIMA-HAMILTON

**1949**

**UNLOVELY, UNSTOPPABLE:** Learning from the BL1/BL2 flop, not to mention the Alco RS1 and RS2, in October EMD gets it right when it introduces Chief Engineer Dick Dilworth's "unlovely"—but unstoppable—road-switcher creation, the 1,500 h.p. General Purpose GP7. The "Geep" (that's Texas & Pacific GP7 1113 greeting an F7 set) is born, and multiplies fast. LINN H. WESTCOTT

**1949**

**DOODLEBUG REDUX:** In September, the Budd Co. introduces its modern twin-underfloor-engined doodlebug, the Rail Diesel Car, as RDC1 demonstrator 2960 embarks on an 18,000-mile nationwide tour. In 13 years, Budd will deliver 398 RDC's to 26 railroads and 4 overseas operations. BUDD




**1949** **BALDWIN QUITS STEAM:** BLW's last domestic steam locomotive, C&O H6 2-6-6-2 1309, is built in September.

**1949** **BIG-TIME VICTORY:** Gulf, Mobile & Ohio announces complete dieselization on October 15, at Columbus, Miss., to become the first large U.S. road to kill steam. The event rates national news coverage, including a spread in *Life* magazine.

**1950** **DOMINION DIESELS:** EMD expands into Canada, opening the General Motors Diesel Ltd. locomotive assembly plant at London, Ontario, on August 8.

**1950** **LOCOMOTIVE FLOOD TIDE:** U.S. railroads put more new locomotives into service in the first 10 months of 1950 than in any corresponding period in the past 27 years: 1,915 diesel, 9 steam, and 8 electric. Another 1,496 diesels, 19 steam, and 8 electric locomotives remain on the order books. A total of 4,027 diesel locomotives, worth more than a half-billion dollars, are ordered by U.S. roads in 1950, with EMD holding 65 percent of the market.

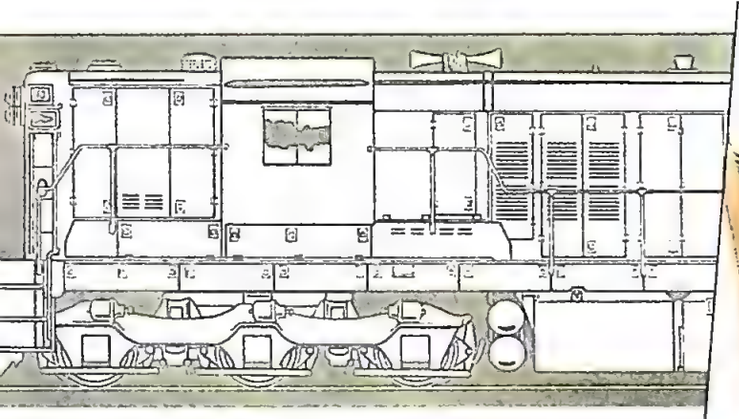
**1950** **SURPRISE MERGER:** Baldwin Locomotive Works and Lima-Hamilton merge to form Baldwin-Lima-Hamilton on November 30. Baldwin wants Lima not for its locomotive line but for non-rail assets such as its shovel and crane division. Lima completes its last locomotive, 2,500 h.p. center-cab transfer diesel Pennsylvania 5683, on September 11, 1951.

**1950** **CLASS 1 LOCOMOTIVE COUNT:** 14,047 diesel, 25,640 steam

**1951** **CENTRAL SETS A RECORD:** The New York Central in March announces orders for 387 new diesels from EMD, Alco, FM, and BLH, the largest-ever locomotive-buying binge by a U.S. railroad, eclipsing the previous record set just a year earlier by rival Pennsylvania for 226 units.

**1950 ILLINOIS CENTRAL SAYS NO:** IC President Wayne A. Johnston tells the *Chicago Journal of Commerce* that his coal-hauling road "will not dieselize its freight services for a long time, if ever." A decade later, IC finally is among the last carriers to abandon steam. J. SCHMIDT PHOTO, KRAMBLES-PETERSON ARCHIVE

**1950 BELOIT'S BID FOR THE BIG-TIME:** Fairbanks-Morse introduces its "Consolidation Line" of freight and passenger diesels. Available in cab and booster versions rated at 1,600, 2,000, and 2,400 h.p., the C-Line is cataloged in 14 models. Two CPA24-5 demonstrators tour nationwide, but it's late in the cab-unit era, and sales are slim. ROBERT M. STACY



**1952 SIX MOTORS FOR LA GRANGE:** Late to the six-motor party, EMD in February expands its model lines with the introduction of the 1,500 h.p. SD7, heralded by demonstrator 990, direct ancestor of thousands of SD40's, SD70's, et al.

**1953 "MR. BIG" HITS THE ROAD:** Fairbanks-Morse introduces the 2,400 h.p., six-motor Train Master, the "Mr. Big of road-switchers." Demonstrators TM-1 and TM-2 depart Beloit on May 16 for the Railway Supply Manufacturers' Association exposition in Atlantic City, N.J. Sister demos TM-3 and TM-4 are subsequently outshopped and embark on a sales tour. Lackawanna orders 10 TM's sight unseen, but the brute is ahead of its time, selling only 127 units to 10 railroads.

**1951 TURBINES, ELECTRICS . . .:** Union Pacific, after testing GE gas-turbine-electric No. 50 for nearly two years, orders 10 similar units, first of an eventual fleet of 55 UP turbines. Meanwhile, PRR orders 5 two-unit electrics from GE and Westinghouse, precursors of the road's 66 E44 freighters.

**1951 . . . AND STEAM:** With the builders out of the steam business, and all other major railroads committed to diesels, Norfolk & Western stands out as steam's last great champion. In October, the coal road commissions its Roanoke, Va., shops to build 15 S-1a 0-8-0's and 6 Y-6b 2-8-8-2's.

**1951 FADING FIRES:** The Lehigh Valley ends steam usage as 2-8-2 No. 432 arrives at Delano, Pa., on September 14 with a freight from Packerton, making the LV, once a major anthracite hauler, the first big Eastern road to fully dieselize. . . . Texas & Pacific becomes the first major carrier in the Southwest to go all-diesel as 2-8-2 No. 800 works Shreveport-New Orleans train 28 for the last time on November 9.

**1952 N&W SAYS NO DICE:** In September, the Norfolk & Western tests an A-B-B-A set of Electro-Motive F7 freight units for 18 days. Apparently unimpressed, N&W sends the diesels packing without an order.

**1953 DIESEL-BUILDER DIVORCE:** General Electric goes its own way, dissolving the Alco-GE partnership formed in 1940. Alco still uses GE electricals for its diesels.

**1953 LAST NEW U.S. STEAM:** N&W's Roanoke Shops in December completes S-1a 0-8-0 No. 244—the last reciprocating steam locomotive constructed for a U.S. railroad. . . . Hoping to stick with coal as a fuel, the following year N&W introduces experimental C-C+C-C 4,500 h.p., Baldwin/Babcock-Wilcox/Westinghouse steam-turbine-electric No. 2300. *Jawn Henry*, as the big fellow is known, proves no match for diesels, and dies an orphan.

**1953** **LOOKING AHEAD IN THE SOUTH:** Southern Railway officially says good-bye to steam on June 17 as 2-8-2 6330 arrives in Chattanooga with a freight from Oakdale, Tenn., pausing for the company photographer between a *Best Friend of Charleston* replica and an A-B-B-A set of F units before yarding her train and dopping her fire for good. Steam will return to SR in 1964, but only for fun.

**1954** **MR. BIG GETS COMPANY:** Alco takes on FM's Train Master, introducing the six-motor, all-purpose 2,250 h.p. DL600 (a.k.a. RSD7) hood unit.

**1956** **TOMORROW NEVER CAME:** GM's entry in the ultra-lightweight derby is the *Aerotrain*. Two sets, with cars based on bus bodies, are built, along with LWT12 locomotives to pull them (a third LWT12 goes to a Talgo consist). Far from trend-setting, all end up on Rock Island commuter runs.

**1956** **ALCO TURNS UP THE HEAT:** Alco in February introduces a new model line of road-switchers powered by the new 251 engine. First is the 12-cylinder, 1,800 h.p. B-B RS11 (or DL701, above), followed by a C-C version, the RSD12 (DL702). The big guy in the lineup, though, is the 16-cylinder, 2,400 h.p. C-C DL600b, or RSD15. ALCO

**1953** **OUT OF STEAM:** For the first time since 1828, not a single U.S. railroad or industry orders a new steam locomotive. Diesels, meanwhile, move 74 percent of railroad freight tonnage, 79 percent of all passenger trains, and do 83 percent of switching work. EMD holds 73 percent of the U.S. locomotive market, Alco 15 percent, FM 7 percent, and BLH 5 percent.

**1954** **THE BEST GETS BETTER:** Electro-Motive introduces the 1,750 h.p. GP9 powered with latest version of its redoubtable prime mover, the 567C. At 4,257 units, the GP9 is the best-selling of all first-generation models.

**1955** **STEAM REVIVAL:** A surge in traffic revives stored steam on many roads that had previously gone all-diesel, including Santa Fe, Soo Line, Milwaukee Road, and C&O.

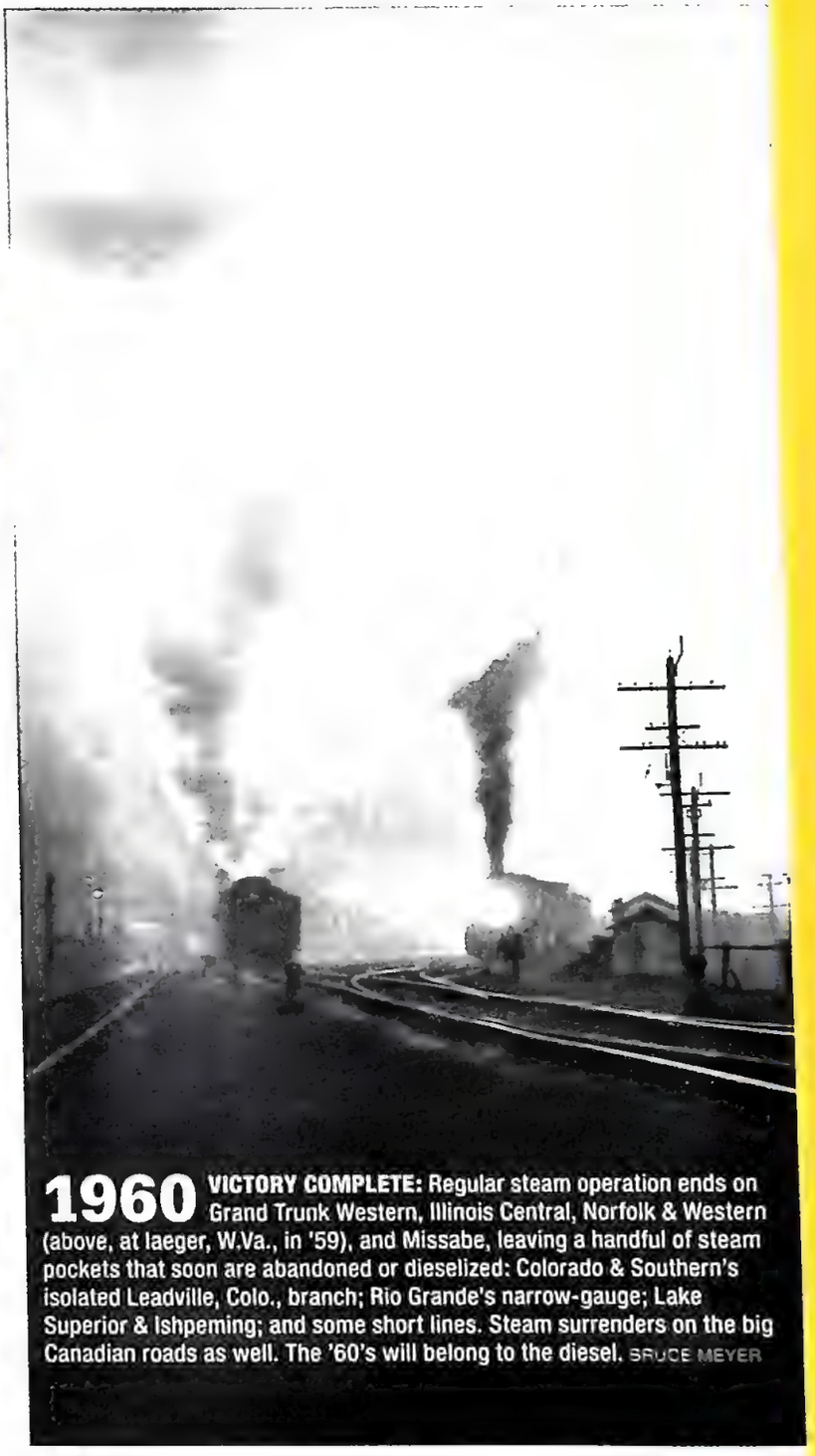
**1955** **ROANOKE RELENTS:** N&W gets its first diesels in October, four GP9's and four RS3's, to dieselize its lightly trafficked Lynchburg, Va.-Durham, N.C., line. "This does not mean we have changed our view that our modern roller-bearing coal-burning steam locomotives can handle the major part of our traffic economically, nor does it mean that our interest in new and better types of coal-burning locomotives has diminished in any way," says N&W President R. H. Smith. By January 1956, though, N&W had ordered 83 more diesels, 58 GP9's and 25 RS11's.

**1955** **CLASS 1 LOCOMOTIVE COUNT:** 24,786 diesel, 5,982 steam

**1956** **BALDWIN BOWS OUT:** Struggling to stay alive, Baldwin-Lima-Hamilton puts its faith in diesel-hydraulic technology. BLH builds locomotives powered by German-built Maybach engines and driven with Mechydro transmissions for "Train X" lightweights for New York Central and New Haven. NYC RP210 No. 20

**1958** **STEAM ON THE RUN:** Northern Pacific declares itself all-diesel on January 17; Baltimore & Ohio officially dieselizes in April; and Nickel Plate's legendary Berkshires ride into the sunset as S-2 746 makes a Bellevue-Conneaut (Ohio) run in July. WALTER G. MINNICH JR.

**1959** **TRADE-INS, AND A NEW LOOK:** Boston & Maine, Milwaukee, and Minneapolis & St. Louis trade in FT's—steam-killers of the 1940's—on new GP9's, and SP gets a few 9's (above) with a "low nose," which will become universal. Also in '59, EMD introduces a souped-up Geep, the 1,800 h.p. GP18. ALAN MILLER; J. DAVID INGLES COLL.



**1960** **VICTORY COMPLETE:** Regular steam operation ends on Grand Trunk Western, Illinois Central, Norfolk & Western (above, at Iaeger, W.Va., in '59), and Missabe, leaving a handful of steam pockets that soon are abandoned or dieselized: Colorado & Southern's isolated Leadville, Colo., branch; Rio Grande's narrow-gauge; Lake Superior & Ishpeming; and some short lines. Steam surrenders on the big Canadian roads as well. The '60's will belong to the diesel. BRUCE MEYER

emerges from Eddystone in May; NH 3000-3001 follow in October. The trains—Central's *Xplorer* and NH's *Dan'l Webster*—and their unique locomotives are withdrawn by spring 1960, though. BLH ships its last common-carrier-size diesel, Erie Mining S12 403, on October 30; completed in '55, the unit had been held for use in testing the diesel-hydraulics. The last big diesel *finished* at Eddystone, Columbia Geneva Steel S12 35, is shipped August 6, along with sisters 33-34.

**1956** **QUICK CHANGE:** C&NW dieselizes its Chicago commuter trains May 11 simply by reassigning existing locomotives.

**1957** **THREE BIG DOMINOES FALL:** Eastern and Western giants New York Central, Pennsylvania, and Southern Pacific declare themselves fully dieselized.

**1958** **SATURATION:** U.S. Class 1 roads take delivery of a mere 434 new diesels, compared with 1,316 in 1957—an indicaton that dieselization is nearly complete.

**1959** **SUMMER OF DEFEAT:** Two more steam strongholds drop their last fires as Nickel Plate 0-8-0's, brought back to work at Conneaut, Ohio, during a traffic upswing, are put away July 18 when a steel strike depresses rail traffic levels. Similarly, on July 23, 4-6-6-4 Challenger 3713 brings Union Pacific's last steam-powered revenue freight into Cheyenne, Wyo.

**1959** **SECOND GENERATION DAWNING:** The second generation of diesel-electrics is here as EMD introduces the 2,400 h.p., turbocharged SD24. It will sell just 224 units to five roads, but presages the big SD's of today. Also new for '59: the 2,000 h.p. turbocharged GP20.

**1960** **CLASS 1 LOCOMOTIVE COUNT:** 28,278 diesel, 261 steam

# Hermann Lemp

## He harnessed the diesel

CLASSIC TRAINS COLL.; BELOW, GE

Thanks to a Swiss-born inventor working for GE, diesel-electric locomotives became a reality

BY **CARL BYRON**

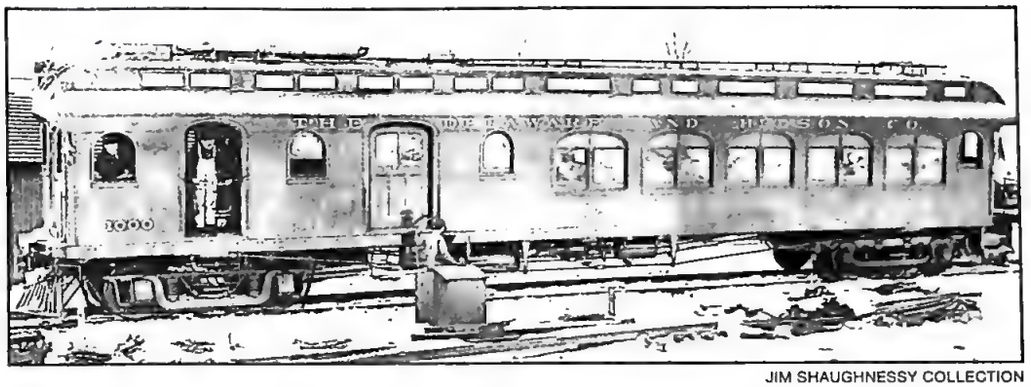
In 2005, Dr. Hermann Lemp is all but forgotten, despite his being a truly inventive genius whose patents range from automatic coffee brewers to X-ray machines. Many railroad motive-power historians remember him, though, for his development and perfection of the automatic feedback loop control that made diesel-electric power initially possible and ultimately practical.

Born in Berne, Switzerland, on August 8, 1862, Lemp began his education in that city and continued it at Zurich, Burgdorf, and Neuchatel. He graduated from high school in 1878 and became a student electrician at Mathias Hipp's works in Neuchatel, a manufacturer of electric clocks and other instrumentation.

Lemp subsequently visited the 1881 Electrical Exhibition in Paris, where he "first became acquainted with the name 'Edison'." Greatly impressed by the Edison Electric Light Co.'s exhibit, he immediately sailed for America, and contacted Charles Clarke, Edison's Chief Engineer. Clarke was likewise impressed. The young man had not only crossed the Atlantic purely in hopes of employment with Edison, but presented Clarke with a differential galvanometer that Lemp himself had designed and hand-built. Shortly, Hermann Lemp was employed at Edison's innovative laboratory in Menlo Park, N.J.

Thomas Edison had built an electric locomotive and a 1,400-foot test-track loop at Menlo Park in 1880. During January 1882, Lemp saw Edison and an assistant trying to free the locomotive from a snowdrift. Lemp subsequently recalled his life-threatening introduction to electric traction in a World War I-era

**Lemp became Works Manager in 1912 of GE's new Erie, Pa., plant. In this early view, Lake Erie is at upper left, NYC and NKP Buffalo-Cleveland lines are at right.**




JIM SHAUGHNESSY COLLECTION

**GE's first gas-electric, D&H 1000, showed promise but was difficult to operate because it lacked a system to automatically coordinate the engine and generator.**

letter: "Mr. Edison allowed me to crowd onto the locomotive (although it was none of my business), when in going backwards I was thrown off. I rolled over the rail as quickly as possible, and can yet see Mr. Edison looking from the cab, saying, "Are you killed?' "

Lemp's assignment at Menlo Park was to assist Dr. Herman Claudius in finalizing the engineering design and details of the second phase of Edison's pioneering direct-current lighting of 10 city blocks of lower Manhattan. The project was developed with the use of a model-board layout of all streets and feeder wiring involved, not by mathematical calculations. Lemp spent hundreds of hours at the model board winding and installing tiny coils of resistance wire representing each individual street lamp. When those initial 5,000 street lamps burst into light with the power generated at Edison's Pearl Street Station on September 4, 1882, America entered the Age of Electricity.

Lemp traveled to Switzerland and married on June 29, 1883. He and his bride returned to America that fall, and he soon joined the Schulyer Electric Co. of Hartford, Conn. In 1887 Schulyer was acquired by the Thomson-Houston Co. of Lynn, Mass., Edison General Electric Co.'s major competitor.

Promoted to chief engineer of T-H subsidiary Thomson Electric Welding Co. in 1889, Lemp subsequently invented and patented the first resistance-based electric welding equipment and associated electrical control devices. The major impetus to developing resistance welding was the need to weld, in place, street-railway rails. Lemp was justifiably proud to note nearly two decades later that the first rail-welding machine of his design sold was still operating after producing some 250,000 welds.

Since the welding equipment used alternating current while the trolley lines used D.C., Lemp developed a unique rotary converter. Rather than use a large D.C. motor attached directly to an A.C. alternator, Lemp built a D.C. motor with both a commutator and brushes for D.C. input and slip rings, for simultaneous A.C. output. Rotary converters subsequently found wide application in railroad and transit electrifications until the mid-1950's, when heavy-duty rectifiers superceded them.

In 1889 GE absorbed Frank Sprague's Electric Railway & Motor Co., thereby entering the booming street railway and traction industry. Three years later Thomson-Houston and Edison General Electric merged, forming General Electric. Thus did Hermann Lemp return to his former employer by indirect means.

Lemp in 1895 joined GE's Thomson Research Laboratory, where experimentation with the newly discovered X-ray phenomenon was occurring. The automobile was concurrently entering the scene, and the laboratory experimented with both steam- and electric-powered models. Hermann—now Dr.—Lemp was directly involved with all three endeavors. Patents reflecting his efforts include A.C.-to-D.C. rectifiers to increase X-ray penetration; high-pressure "flash" steam boiler designs; and the automotive internal drum brake, to name only three. He was very satisfied to remain at the GE facilities in Lynn, Mass., as the 20th century dawned.

Shortly thereafter, Lemp turned his attention to "automobiles with gasoline engines as prime mover with electric drive to the wheels." He was ahead of his time with the automotive applications, but a more immediate use beckoned: the rail motor-car market.

Although GE was primarily interested in high-voltage D.C. electric traction, by 1904 the firm was investigating the development and sale of internal combustion railcars. In theory, a gas-electric car would be much less expensive to operate than a steam-powered train of comparable capacity, so it showed promise. By early 1906, GE had a gas-electric under test. Created from a Wason-built wooden combine car and an imported (from England) Wolseley 140 h.p. gasoline engine powering a GE D.C. generator, Delaware & Hudson No. 1000 was the first gas-electric car in North America. The challenge of manually operating the gasoline engine's throttle and balancing the electric generator's output quickly became one of the two major factors—the other being the reliability of the gasoline engine itself—limiting the sales appeal of the gas-electric car.

In 1910 Dr. Rudolph Diesel visited the United States from Germany to promote the use of his compression-ignition oil engine. During the visit he met with members of GE's Gas-Electric Department in Schenectady, N.Y., including Lemp.

GE in 1911 moved its Gas-Electric Department from Schenectady to a new facility in Erie, Pa. There, while other members of the gas-electric group—including Henry Chatain and Richard Dilworth—worked to create a viable internal-combustion engine, Hermann Lemp threw his energies into creating a control package to automate the interconnection between the engine and the generator. He received patent No. 1,216,237 on June 24, 1914, followed by patent 1,313,097 on July 12, 1919. In addition to his creative duties, Lemp became Works Manager in 1912.

Both of Lemp's initial patents used electro-mechanical/hydraulic means to match generator output to engine speed. Although his designs worked, and were a noticeable improvement over the previous "Modified Ward-Leonard Control," their mechanical/hydraulic design made them prone to failure and difficult to keep in good repair. An all-electric solution was necessary.

After selling 120 or so railcars between 1906 and 1917, GE suspended the program for the duration of World War I. With no orders on the books, it disbanded the Gas-Electric Department after the Armistice. However, GE did retain interest in diesel engine development and constructed three primitive diesel-electric locomotives in 1917-18. Concurrently, Lemp continued with his control research work, primarily using a small four-wheel gas-electric locomotive nicknamed "Bumble Bee." Beginning in June 1916, this machine burbled around GE's Erie Works for a decade, testing various control systems devised by Lemp, including the first application of his "self-regulating" control in 1919. The little fellow lasted at Erie into the 1940's.

In 1920, GE forwarded a request for proposal developed by Lemp to engine builders nationwide for a 300 h.p. diesel suitable for locomotive application. Only the Ingersoll-Rand Co. responded, and in 1921 an agreement between the firms was reached. While Lemp was watching the

JACK ROSCOE COLLECTION

**An encounter in the cab of Alco demonstrator No. 600 (later NH 0900, the road's first diesel) brought the "visionary" Lemp face-to-face with his former GE colleagues.**

development of I-R's engine from Erie, Harold Hamilton showed up at GE in 1922 with his ideas of how to resuscitate the gas-car market. Without Lemp's implicit—if not direct—backing, it's likely GE would have followed Westinghouse's example and sent Electro-Motive's founder away empty-handed. How different motive-power history would then have been.

In 1925, after more than three decades with General Electric, Lemp departed and joined the Erie Steam Shovel Co. to lead development of a gas-electric-powered shovel. With the project completed, Lemp in 1926 set up his own consulting business, Lemp Laboratories, and was promptly retained by Ingersoll-Rand.

The I-R factory in Phillipsburg, N.J., supplied the 300 h.p. prime mover for the first commercially successful diesel-electric locomotive, Central Railroad of New Jersey 1000, introduced in October 1925. The carbody was by Alco and the electrical gear from GE. Lemp's fingerprints were all over the locomotive's prime mover and electrical systems. I-R continued to advance diesel-electric development, and Lemp retained his consulting contract until 1938.

Those first 300 h.p. Alco/GE/I-R box-cab locomotives contained the latest Lemp control system. Lemp's redesigned all-electric control was assigned patent No. 1,589,182 on July 16, 1926.

Additional control features were incorporated into the design based upon field experiments done by Lemp himself on the early Alco-GE locomotives tested on the New York Central's Putnam Division circa 1928-31. The system's feedback loops between the generator, auxiliary generator, and the internal-combustion engine's throttle control formed the basis for control of all diesel-electric locomotives until the arrival of variable-frequency A.C. drives in the early 1990's. Currently manufactured locomotives using D.C. motors and control technology are still based upon Hermann Lemp's control concepts and patents of more than 75 years ago.

One of the most memorable occasions in the modest, almost shy, inventor's career occurred on the New Haven Railroad in early August 1931. Alco 600 h.p. diesel-electric switcher No. 600 had arrived at Bell Docks, in New Haven, Conn., to begin its demonstration. Along with New Haven and Alco upper management, present was a contingent of GE executives as well. One can easily imagine the faces of the GE vice presidents as they entered the locomotive cab only to be graciously met by Hermann Lemp, the man a decade earlier they denigrated as an impractical dreamer. Able to contain himself no longer, the smiling Lemp finally remarked, "When I left the company, gentlemen, you called me a visionary."

After an uncomfortable silence, one vice president responded, "But a visionary is a man of vision. Only vision could have foretold the oil-electric locomotive."

On December 24, 1931, the Alco demonstrator became New Haven 0900, the railroad's first diesel-electric locomotive.

At an age when most men would be contemplating, if not enjoying, retirement, Lemp continued to innovate over wide-ranging fields of endeavor. Perhaps the most unusual patent he acquired during his consulting years was filed on May 3, 1937, for a coffeemaker "controlling device." The Silex Co. acquired the rights to the automatic thermostat, and Proctor-Silex still manufactures automatic coffeemakers today. Lemp commented privately regarding the "comfortable royalties" he received from Silex that this patent was ". . . almost the only patent that I ever owned by myself. All the rest belonged to the companies I worked for."

In 1939, Lemp contributed a number of hand-built scale locomotive models that were displayed in the Railroad Building at the 1939-40 New York World's Fair.

An indication of how Lemp's patents were regularly dusted off and reused in new and different applications is exemplified by an excerpt from a letter he received from a J. A. McManus at GE dated November 16, 1939: ". . . of the most importance is the similarity between the principles involved in the Surrey and that in the steam-electric locomotive built for the Union Pacific."

The patent in question involved the continuous tube flow-through "flash" boiler design first used in the steam-powered two-seater "Surrey" automobile constructed at GE's Thomson Labs circa 1896. The matter was soon academic, as within a matter of months the two UP "Steamotives" followed the Surrey into oblivion.

At age 86, Lemp was awarded the George R. Henderson Medal—an honor reserved for the development of new railroad technology—by the prestigious Franklin Institute of Philadelphia. Previous recipients included railroad executive Ralph Budd, Lima's William Woodard, and New York Central's Paul Kiefer.

Letters of recommendation for Lemp came from numerous railroads and suppliers, including R. Tom Sawyer, president of Alco. However, letters from GM's Electro-Motive Division, the organization that at the time had benefited more than any other from the Lemp controls, are conspicuous by their absence. It takes little reading between the lines to presume that GM desired Electro-Motive Chief Engineer Richard Dilworth to receive the award—particularly since GM's New York office sent a copy of *On Time: The Story of Electro-Motive Division*, to each member of the Franklin Institute's awards committee!

During an interview several years before his death, Lemp stated his simple, modest goal in life, "To build, out of many [unrelated] parts . . . a single whole, that is what I have liked to do." He succeeded, having left more than 300 patents in innumerable fields. From our morning coffee, to the X-ray machine in our doctor's and dentist's offices, to the diesel-electrics powering freight or commuter trains, we benefit from his accomplishments every day. Modern society would not be the same without the efforts, genius, and vision of Hermann Lemp.

Lemp died in Ridgewood, N.J., on March 31, 1954, and was buried at the Pine Grove Cemetery in Lynn, Mass., the city where he developed so many of his early inventions. His wife of 70 years died 2½ months later. ■

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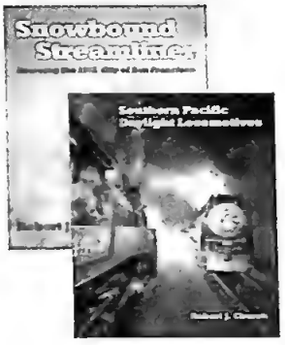


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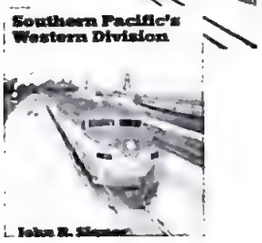


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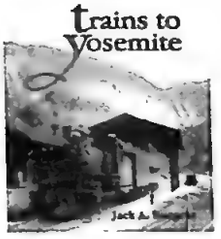


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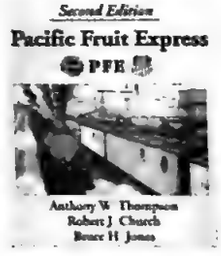


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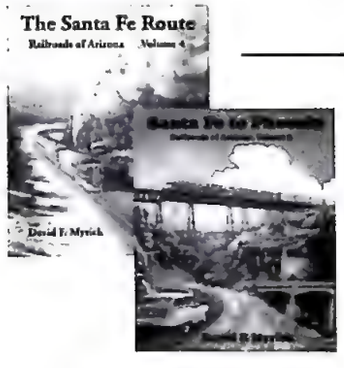


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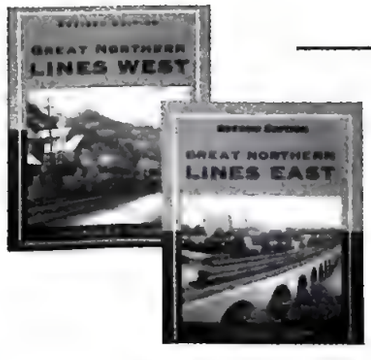


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BUILDER PROFILES

# Baldwin

# bigger they are, the harder they fall

The oldest steam builder died when diesels came

BY **GREG McDONNELL**

Samuel M. Vauclain, president of the Baldwin Locomotive Works, was not amused. Standing at the table of a young draftsman in 1923 or '24, Baldwin's boss examined drawings for the company's first "oil electric" locomotive. Baldwin, builder of more than 50,000 steam locomotives since Philadelphia, Germantown & Norristown's *Old Ironsides* rolled out of Mathias Baldwin's Philadelphia shop in 1832, was ready to embrace the diesel. However, the proposed 300 h.p. prototype inked on the diagrams unfurled before Vauclain were far from his ambitious visions of high-horsepower diesels.

Steam was the company's stock and trade, but Baldwin was no stranger to internal-combustion power, having built small gas-mechanical locomotives for industrial plants as early as 1910. Vauclain saw the potential of diesel technology and understood the stakes. He swept the drawings from the board, declaring, "Young man, Baldwin never builds horsepower in the hundreds; we build in the thousands."

Mighty Baldwin stumbled out of the gate, however. Its first efforts, 1,000 h.p., A1A-A1A box-cab 58501 of 1925, and B-B 61000 of 1929, were powerful

**Kennecott Copper DRS-6-4-1500 No. 901, built as Baldwin demo 1501, is at Bingham, Utah, in September 1950. A few tracks over, steam is being scrapped.**

GEORGE KRAMBLES PHOTO, KRAMBLES-PETERSON ARCHIVE



GEORGE KRAMBLES PHOTO, KRAMBLES-PETERSON ARCHIVE

J. DAVID INGLES COLLECTION

Baldwin did best with switchers like Southern 2294 (at Greensboro, N.C., in 1962), one of 451 sturdy S12's built at Eddystone between 1951 and '56.

EDWARD THEISINGER

"Babyface" was the term given to Baldwin's cab units of 1945-48. Jersey Central 78, a 1,500 h.p. freighter usually part of an A-B-A set, is at Bayonne in '52.

for their time, but they failed to live up to expectations. Neither the Knudsen Motor Corp. V-12 diesel employed by BLW 58501, nor the 61000's 4-cycle, German-built, 6-cylinder Krupp, was deemed satisfactory.

Road tests with 58501 on the Reading, and 61000's 1929-31 tour of Midwestern roads were successful enough, however, to convince Baldwin to invest precious Depression-era dollars in the 1931 purchase of I. P. Morris & De La Vergne, Inc. With experience in oil and diesel engines dating to 1893 and a line of stationary and marine diesels, De La Vergne was just what the doctor ordered. Baldwin, by this time located in Eddystone, Pa., commenced a development program that would ultimately spawn the VO diesel engine and production-model diesel locomotives.

Eddystone mated the new 660 h.p. De La Vergne VO diesel with the cast frame of its first end-cab switcher, test bed-demonstrator 62000, in fall 1936. The paint on BLW 62000 was barely dry when Baldwin accepted its first order for conventional diesel switchers, three m.u.-equipped 900 h.p. units for New Orleans Public Belt. Carrying model designation 8 DE 900/1, NOPB 31-33 marked a decisive diesel victory, as the New Orleans terminal road had considered 0-8-0's and 0-10-0's before choosing Baldwin diesels to work its heavy transfers over the new 4.35-mile Huey P. Long Bridge spanning the Mississippi River.

Delivered in December 1937, NOPB 31-33 presented a case study in the advantages of dieselization. Running 'round the clock, they paired up to drag tonnage over the bridge, worked solo on yard assignments, and patrolled tight-curved industrial spurs off-limits to eight-coupled steam power. During the units' first full year of service, the operating costs (including engine crew wages, fuel, lubricants, and maintenance) for the Baldwins averaged just $3.17 per hour.

Baldwin kept a close eye on the New Orleans trio, as well as former demo 62000, which had been sold to the Santa Fe in spring 1937 and employed in Chicago as ATSF 2200. Based on the performance of its diesel pioneers, Eddystone refined designs and implemented several major changes, including replacing the troublesome cast-frame VO engine block with a fabricated steel design less prone to leaks and stress cracks in the rigors of railroad service.

In 1939, Baldwin unveiled a standardized line of "Model VO" switchers powered by 660 and 1000 h.p. versions of the VO and outfitted with Westinghouse electricals. Westinghouse, which had partnered with Baldwin since 1899 in the construction of electric locomotives, would be Baldwin's exclusive supplier of electrical equipment until 1953.

The VO was a rugged machine that lived up to the Baldwin reputation and earned the respect of railroaders from the Pennsy iron just beyond the Eddystone gates to the logging roads of the Pacific Northwest. Cast frames, oval-shaped radiator grilles, pointed noses, and a confusing array of exhaust-stack configurations gave way to welded frames and simplified carbodies as Baldwin refined its switcher designs and models evolved from VO to DS to S-series designations. Under the hood, the VO was succeeded by normally aspirated and turbo-charged versions of the 608 and 606 prime movers. Their horse-power measured in mere hun-

J. SCHMIDT PHOTO, KRAMBLES-PETERSON ARCHIVE

dreds, but to Vauclain's chagrin, the humble yard engine would prove to be Baldwin's best when it came to diesels.

Two decades after Vauclain ripped into the young draftsman, Baldwin had yet to produce a big road diesel. In the tradition of a builder whose contemporary steam achievements included Santa Fe 4-8-4's, B&O 2-8-8-4's, and SP cab-forward 4-8-8-2's, Eddystone's early efforts to create a diesel equivalent were similarly spectacular . . . and spectacularly unsuccessful.

A 6,000 h.p., 2-D+D-2 experimental cab unit, begun in 1940 and tested briefly in '43 with just half of its intended *eight* cross-mounted V8 engines installed, was a colossal failure. Its successor, the 3,000 h.p., twin 608SC-engined "Centipede" introduced in 1945, fared only slightly better, selling 54 units to three roads (Pennsy, Seaboard, National of Mexico).

Eddystone found better success with more conventional, but nonetheless distinctive, "baby-faced" and "shark-nosed" A1A-A1A passenger and B-B freight cab units, and hood units in 4- and 6-axle configurations. Conventional, of course, was a relative term when it came to Baldwin diesels, for among the models in the catalog were baby-faced, double-cab A1A-A1A passenger units built for Jersey Central, and mammoth double-engined, 2,000 to 2,400 h.p., six-motor center-cab transfer units first custom-built for Elgin, Joliet & Eastern.

In road-switchers, Baldwin beat even RS1 innovator Alco with the first six-axle version as Columbus & Greenville placed 1,500 h.p. A1A-trucked No. 601 in service on October 8, 1946, several weeks ahead of the first similar-sized Alcos. Being first wasn't enough, though. Eddystone's road-switchers, respected for their lugging capabilities yet unable to shed their Baldwin infirmities and idiosyncrasies, were soon left in the dust behind Alco and EMD products.

**Truly distinctive was the "Sharknose" styling introduced in 1948 with PRR's 2,000 h.p. passenger units, two of which are at Englewood, Ill., early in their career.**

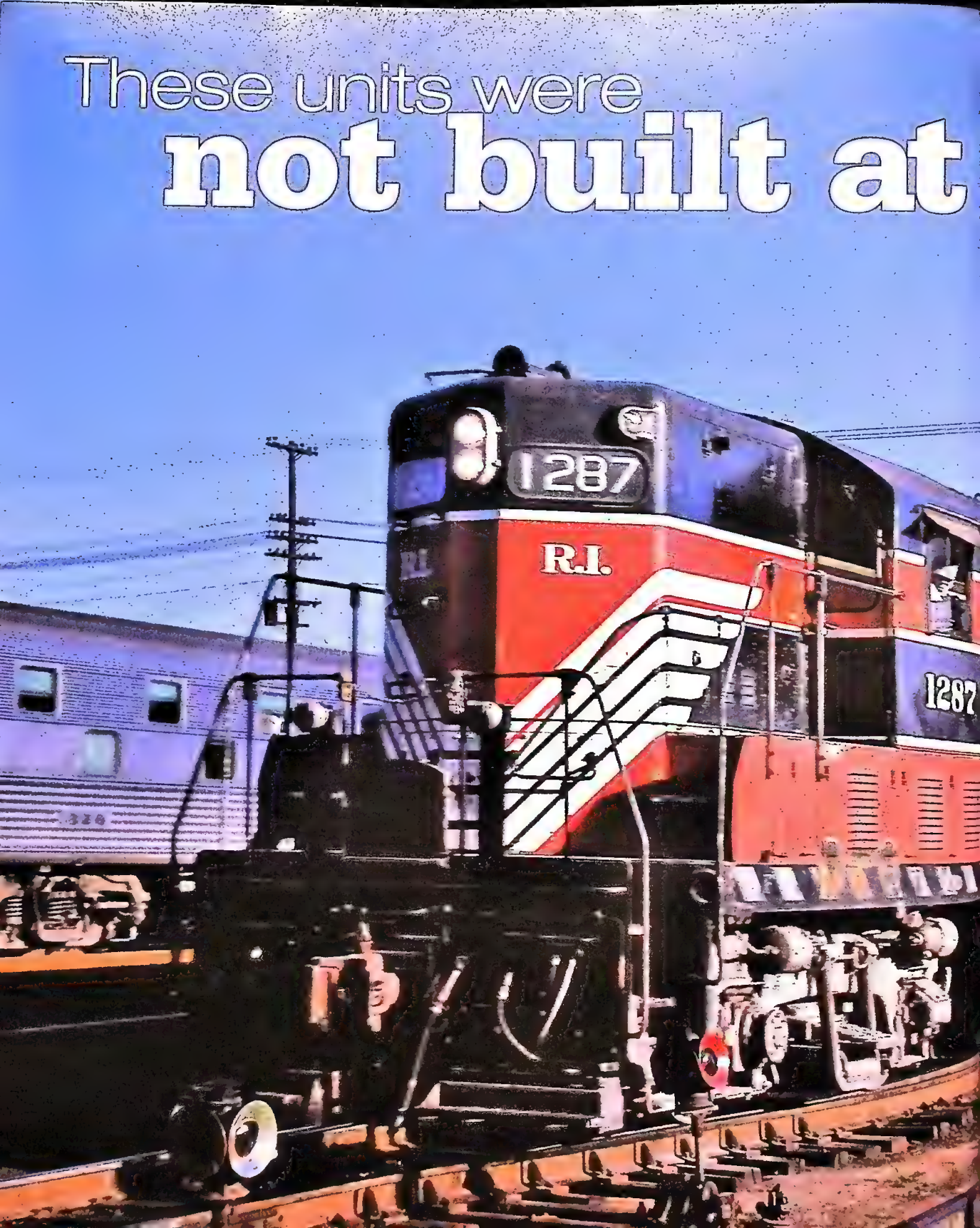
**Baldwin's biggest was the "Centipede," which PRR ran in pairs. Already off their intended passenger runs, two push a freight up Horseshoe Curve in 1951.**

THOMAS J. McNAMARA

Baldwin, for all its success as a steam builder and effort and innovation with diesels, had it tough in the diesel business, consistently lagging far behind the competition. Its August 1950 merger with one-time competitor Lima-Hamilton was a move orchestrated more to acquire the latter's non-locomotive business, including industrial, construction, and mining equipment production.

As the dieselization boom faded in the 1950's, the new Baldwin-Lima-Hamilton, its fortunes built on a century-plus of steam power, saw its future slipping away. Unable to compete with EMD, Alco, and even latecomer Fairbanks-Morse, BLH slipped to fourth place. Even Pennsy, one of Eddystone's most loyal customers, turned away in 1954.

Efforts to develop diesel hydraulics and locomotives for the short-lived lightweight passenger-train craze fizzled, and BLH delivered its last full-size (vs. industrial size) locomotive, Erie Mining S12 switcher 403, in fall 1956. Nearly four years before the last mainline U.S. steam fires were dropped, mighty Baldwin, once one of the world's most prestigious locomotive builders, called it quits, a collateral casualty of dieselization. ■


These units were
not built at
1287
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1287

# La Grange

With the diesel market mushrooming, EMD in 1948 was forced to add plant capacity, and did so at its ancestral home. Plant 3 turned out 3,600 units in six years.

BY ERIC HIRSIMAKI

EMD's Plant 3 in Cleveland initially concentrated on switchers. Indiana Harbor Belt (left) had 110 total NW2's, SW7's, and SW9's. Union Railroad of Pittsburgh (below) owned 22 of the 661 total SW1's built during 1939-1953.

ABOVE, KEN DOUGLAS, J. DAVID INGLES COLLECTION; OTHER THREE PHOTOS, J. DAVID INGLES

Plant 3 built about half of EMD's 2,600 GP7's, including Rock Island 1287 (at St. Paul) and the first 20 (2 of which, below, leave Dearborn, Mich.) of 79 that dieselized the C&O's Northern District.

If you were asked to name the leading diesel-electric locomotive manufacturing facilities in the U.S. between 1926, when diesel switchers first gained a foothold, and 1955, when the wave of dieselization crested, the list would probably look like this: 1) Electro-Motive Division of General Motors at La Grange, Ill.; 2) American Locomotive Co. at Schenectady, N.Y.; 3) Baldwin Locomotive Works at Eddystone, Pa.; and 4) Fairbanks-Morse & Co. at Beloit, Wis.

Such a list omits one facility: EMD's Plant 3 in Cleveland, Ohio, which turned out 3,613 units, well behind Alco's 9,300 but ahead of Baldwin's 2,850. (La Grange, EMD's Plant 1, turned out 14,750 units, and FM 1,350.) Put another way, Plant 3 was the third most prolific producer during the boom years of dieselization.

How did EMD Plant 3 outproduce Baldwin, which had more than a century of locomotive experience? Let's take a look at one of America's more obscure locomotive-building operations.

Although it's most often associated with La Grange, Electro-Motive had its roots in Cleveland, where the firm was formed in 1922 by H. L. Hamilton, to design and market self-propelled motorcars for branchline passenger operations. To power its motorcars, Hamilton's company bought gasoline engines from another Cleveland firm, the Winton Engine Co., ["Winton," pages 38-48, STREAMLINER PIONEERS 2005].

In 1930, General Motors Corp. purchased both Winton and its largest customer, Electro-Motive. GM made the acquisitions because of its interest in diesel engines, for which it saw great potential in various markets, including locomotives.

By 1935, Winton had developed the 201A diesel and EMC was using it in passenger and switching locomotives. The Electro-Motive Co. became Electro-Motive Corp. and moved from Cleveland to Chicago, where in the suburb of McCook (with a La Grange address) it constructed a 200,000-square-foot locomotive plant. GM's emphasis was on standard designs using carbodies built at La Grange, Winton diesel engines from Cleveland, and electrical equipment purchased from General Electric and Westinghouse. Various GM subsidiaries provided other components.

In 1939, EMC developed the new 567 engine, which supplanted the 201A. This marked the end of its relationship with the old Winton plant, which had become known as the Cleveland Diesel Engine Division. While the latter continued to produce its own diesel engines for various other markets, the 567 was produced only at La Grange, although "Cleveland Diesel" modified and marketed 567 engines for marine and industrial use.

## CLEVELAND DIESEL AND THE NAVY

World War II began in Europe in late 1939, and by 1941 the U.S. government was laying the groundwork to increase the production of critical war materiel, including diesel engines. Thus, on November 7, 1941, Cleveland Diesel began discussions concerning construction of a massive new facility in the suburb of Brooklyn on Cleveland's southwest side. A month later the Pearl Harbor attack occurred, with the resultant full mobilization of America's industrial base.

Included in this was a contract, awarded on February 16, 1942, for a new 343,000-square-foot shop to be owned by the U.S. Navy and operated by Cleveland Diesel. Construction started almost immediately. By October, the plant was essentially complete, and the production of new diesel engines began on November 6, 1942, only 364 days after the initial discussions were held.

The new facility was expanded during the war so that at war's end, Cleveland Diesel was operating three facilities totaling 690,000 square feet of floor space. Employment had increased by almost 1,000 percent, and Cleveland Diesel had completed 13,765 engines rated at over 5.3 million total horsepower. More than 5,500 naval vessels used Cleveland Diesel engines. In fact, a large diesel school was established at the plant to train naval personnel, up to 1,200 at a time, on how to operate and maintain the engines. Wooden barracks and attendant facilities were built for the sailors, and eventually the area came to be known as Navy Park.

EMC was also active during the war. It had become the Electro-Motive Division of GM ("EMD") effective January 1, 1941, and greatly expanded its operation during the war. Production capacity increased from about 290 locomotives a year in 1940 to 900 a year in 1946, and the La Grange plant's floor space grew from 665,965 square feet to 2,560,126. Employment increased by over 250 percent during the war as EMD became hard-pressed to meet demands for its products, primarily diesel engines for military programs. EMD did build some diesel-electric locomotives during the war, mainly FT freight units, but most of La Grange's production was allocated by government decree to national defense requirements. Engines totaling over 2.3 million diesel horsepower were produced at La Grange during 1941-45.

It was obvious by the end of the war that a tremendous demand for new diesel-electric locomotives existed, so production

AL CHIONE COLLECTION

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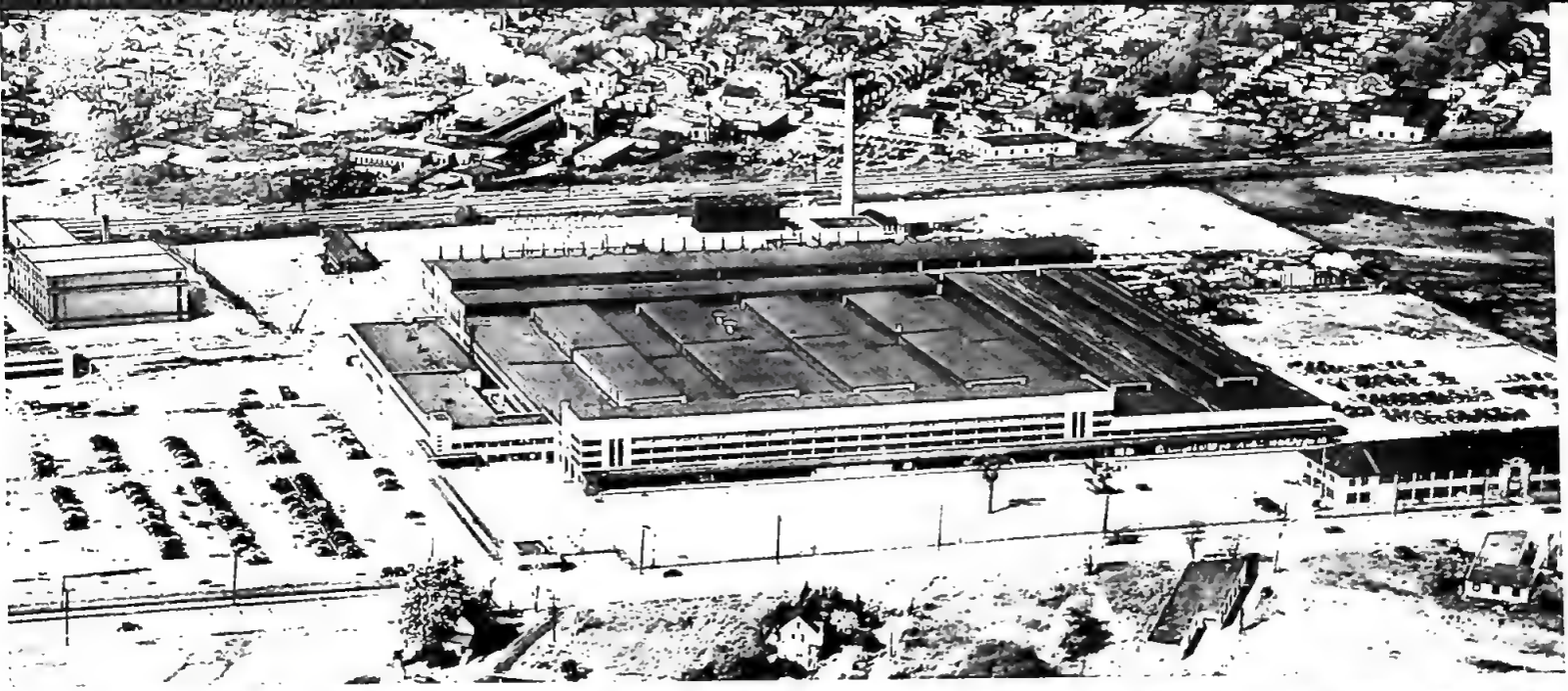
The 343-mile Charleston & Western Carolina, an Atlantic Coast Line subsidiary (as you'd guess from its purple-and-silver colors), had 21 GP7's, all Cleveland-built. No. 201 was on the Plant 3 floor in October 1950, and a year later, sister 202 was at Greenville, S.C.



TWO PHOTOS, EMD: CLASSIC TRAINS COLLECTION

Several SW1's (above), distinctive with their "front and back porches," are on the assembly floor of Plant 3 in Cleveland in 1949 as EMD's second U.S. locomotive-production facility gets rolling.

The plant (top, also in 1949), located in suburban Brooklyn, Ohio, was built in 1941 by the U.S. Navy but operated by GM's Cleveland Diesel Engine Division to build prime movers for naval vessels.

R. R. WALLIN; J. DAVID INGLES COLLECTION

Frisco relied on cab units from EMD and Alco plus 128 GP7's, most if not all built at Cleveland, two of which rolled into Lindenwood Yard in west suburban St. Louis, Mo., in 1958.

of switching, passenger, and freight units resumed at a feverish pace at La Grange. Units were being sold as fast as they could be shipped, which meant EMD lost some orders to its competitors solely on the basis of faster delivery. The railroads cared little about the mechanical advantages of one builder over another—they wanted those money-saving units right now! To boost capacity, EMD leased a plant on Chicago's far south side from the Pullman Company to fabricate noses and other components for E and F units (and later, Geeps), freeing floor space at La Grange for other needs. This became known as EMD Plant 2, but it was Cleveland Diesel that would make the difference during that crucial postwar period.

The end of the war found Cleveland Diesel in a precarious position. Most of its military orders were cancelled, and a glut of war-surplus diesel engines was available. The new plant's manufacturing capacity wasn't needed, so the facility was returned to the government for disposition; the War Assets Administration declared it surplus.

General Motors Vice President R. K. Evans inspected the facility in late 1946 and advised Cyrus Osborn, EMD's General Manager, that the facility would be suitable for locomotive manufacture. In fact, he noted that in some respects it was laid out better than La Grange because it facilitated an assembly-line operation rather than the side-by-side method used at La Grange. The rapid expansion at La Grange during the war hadn't allowed for the most efficient use of floor space. More capacity could and would be added there, but a major investment would be required to substantially increase La Grange's annual output.

The decision to acquire additional manufacturing space wasn't one EMD was happy about having to make. It realized it needed extra capacity to meet the soaring demand for locomotives, but it also knew that by 1955 or so the market would shrink to a level that La Grange alone could handle. On the other hand, delayed deliveries meant many customers would turn to Alco, Baldwin, or Fairbanks-Morse for their locomotives. It was taking EMD more than a year to deliver locomotives already on order, and the situation would worsen. EMD thus had a choice: lose a substantial share of the market or add manufacturing capacity that, in a decade, would be surplus. Buying the Cleveland plant was the most cost-effective solution to the problem.

## LOCALS, SWITCHERS, AND NOISE

A June 1948, *Railway Age* item stated that EMD had acquired the 44½-acre Cleveland manufacturing plant but initially planned to use only 287,000 of the

EMD; CLASSIC TRAINS COLLECTION

K. C. CRIST; J. DAVID INGLES COLLECTION

Cleveland bookends: Southern Pacific SW900 4624 and sister 4625, with SP's characteristic headlight cluster, were Plant 3's last units, in April 1954. Cleveland's first unit, in December 1948, was Rock Island NW2 765, pictured working in Fort Worth, Texas, in 1965.

facility's 460,000 square feet of floor space for locomotive production. The main erecting bay measured 765 feet by 500 feet. About 400 employees were on hand to start retooling the plant when the doors opened in July, but their ranks grew fast as locomotive production began.

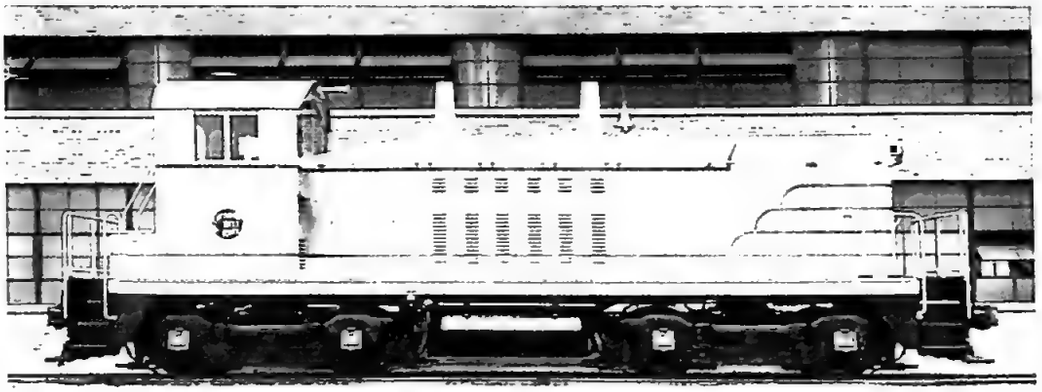
Andrew Finnigan, one of Electro-Motive's original employees, was the first plant manager, and many key people were transferred from La Grange, while others at La Grange were available to resolve engineering or manufacturing questions as needed. As the number of Cleveland employees grew, most foreman positions were filled by promoting local employees. One ironic note was that EMC originally had planned to locate its main plant in Cleveland, near the former Winton plant, but chose La Grange instead; now it was occupying one of the former Winton division's plants.

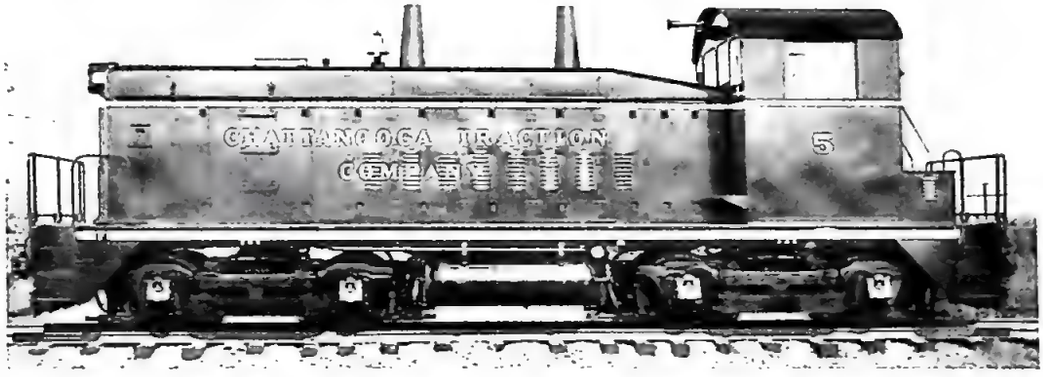
The Cleveland facility was designated Plant 3. It would assemble only switchers because they required little more than mounting the engine and other equipment on a frame. The E and F road units produced at La Grange used a truss carbody and streamlined nose that was far more complicated to fabricate and assemble. The Cleveland shop was retooled to produce locomotives, although ironically, no diesel engines were built there. Most of the major components, such as the 567 engines produced in La Grange, were shipped to Cleveland from other EMD plants. After December 1948, almost all new EMD switchers were built in Cleveland, the primary exceptions being prototypes of new models and experimental designs such as a diesel-hydraulic unit.

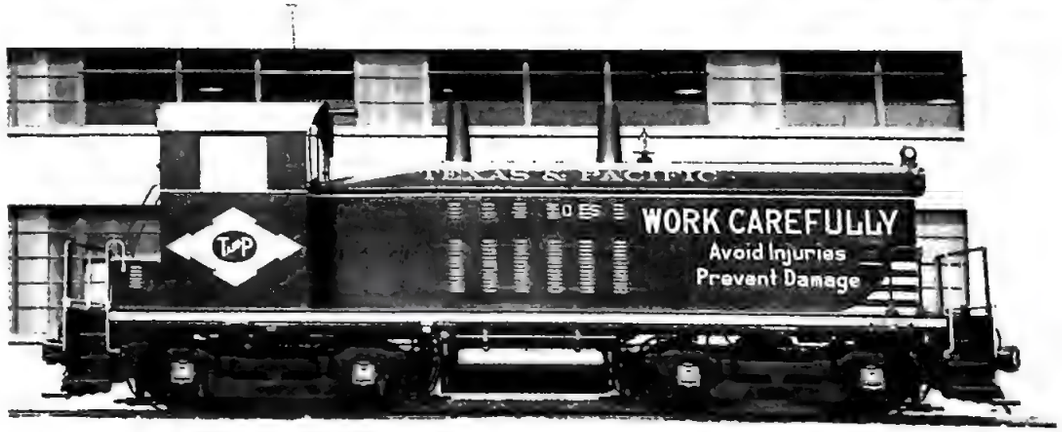
Many former employees recall with a smile one aspect about the conversion of the facility into a locomotive plant. When Cleveland Diesel produced engines, they were test-run in part of the main building. To reduce noise levels, a concrete-block wall separated this area from the rest of the shop. During the conversion, the block wall was removed. Many are the stories of working with a sledge to knock down the wall. However, while this opened up the shop's floor space, it soon became apparent the plant was cooler than before—the diesel engines under test had produced not only noise, but heat.

One disappointing feature of the new shop was that the overhead cranes lacked the capacity and vertical clearance to lift a completed locomotive, with or without its trucks. This meant the assembly line had to be kept moving.

The shop was equipped with the expected heavy industrial tools. Plates up to 4 inches in thickness, used for locomotive frames, could be cut using automated burning torches. Hydraulic shears could








FOUR PHOTOS, EMD, ERIC HIRSIMAKI COLLECTION

**Switcher gallery (from top): Cotton Belt 1050, first of its four 1949 NW2's, wears the same gray-and-yellow livery SSW's FT's did. Chattanooga Traction, a Southern subsidiary, had this 1950 SW9 and 1941 SW1 No. 4. SP 4622, a 1954 SW8, had dynamic brakes (grids in front of cab). T&P 1015 was the first of five May '49 NW2's, last of 20 total on the road.**

RAIL PHOTO SERVICE GENE HUDDLESTON

EMD. ERIC HIRSIMAKI COLLECTION

**Multiplicaton: Only 2 three-unit "herds"—an NW2 control unit "cow" and two cabless NW2 "calves"—were built, both for Chesapeake & Ohio. One of them (top) rounded up cars in a C&O yard during a 1948 coal strike. Burlington bought 14 TR2 cow-calf sets (one from La Grange in 1947, the rest in '49), but in 1954 had EMD put cabs on the boosters and split up the pairs, although as individual NW2's they kept their "booster" numbers, 9400B-9413B.**

bend half-inch plates, while huge hydraulic presses could form steel plate into the many shapes needed to construct a locomotive. Other tools accomplished a variety of tasks. Several of the traveling overhead cranes moved and positioned parts during the assembly process.

Perhaps the most interesting equipment in the plant was the large positioners that could hold and tilt underframe components so they could be welded at the correct angle. Many parts such as trucks and cabs were assembled upside-down, then turned over and added to the locomotive. With all of La Grange's experience to draw from, the EMD engineers were able to design an efficient locomotive assembly operation.

Plant 3 shipped its first locomotive, Rock Island NW2 765, in December 1948. It and four sisters delivered that month comprised Plant 3's total 1948 production, a far cry from the 1,317 units that left La Grange that year. Locomotive models produced in Cleveland would include the venerable 600 h.p. SW1, the 1,000 h.p. NW2, and the 2,000 h.p. TR2 (a pair of back-to-back NW2's, one minus the cab and controls, popularly called a cow-and-calf). By February 2, 1949, the plant had shipped 31 units and had 600 employees working two 8-hour shifts, five days a week. It was producing one switcher a day, although plans were being made to double that.

During 1949, the facility's first full year of production, Plant 3 outshopped 491 switchers, about one-quarter of EMD's total output through the years. Included: 91 SW1's, 321 NW2's, 17 SW7's, 28 twin-unit TR2's, and 2 triple-unit TR3's. The TR3's were unique—known as a "herd," they consisted of one NW2 and two cabless units. Only two herds were built, both for Chesapeake & Ohio.

The replacement of the NW2 with the 1,200 h.p. SW7 in EMD's catalog occurred in October, part of EMD's introduction of the "7" line headlined by the GP7, but the NW2 and SW7 were produced concurrently until the end of the year. The first SW7, Indiana Harbor Belt 8835, was built at La Grange, but the SW7's for IHB and parent New York Central that followed all came from Cleveland.

## RIDING THE GEEP TO SECOND PLACE

The most significant change for Plant 3 was the inclusion in its production schedules of the GP7 road-switcher, the first "Geep" model. The first GP7 demonstrator, EMD No. 100 ("1100" in some retouched publicity photos) was built in La Grange in 1949 as the successor to the earlier BL2, which numbered fewer than 60 units. The Geep was meant to correct various problems inherent in the BL2 design and would compete with other builders' road-switcher models, although EMD originally envisioned only a small market for the GP7.

EMD planned to produce the GP7 in Cleveland only, since it was similar to the switchers in layout and assembly, but much to EMD's surprise, the design became so popular so fast that by fall 1950, EMD was also assembling Geeps at La Grange to keep up with the orders. La Grange built the second demonstrator GP7, No. 200, and Cleveland's first GP7 was the third demonstrator, No. 300, which left the shop in January 1950 for a demonstration tour that included Illinois Central and other southern railroads. Concurrently, Plant 3 completed the first production GP7's, a six-unit order by the Nashville, Chattanooga & St. Louis.

The new GP7 was offered with two different air-brake systems and two choices of trucks. For branchline and secondary service, the GP7 was offered with 6BL air-brake equipment that couldn't be operated in multiple. It was available on either switcher trucks or the standard Blomberg trucks used on road locomotives. For mainline service, the GP7R, as it was briefly called, was offered with 24RL air-brake equipment that allowed it to be operated in multiple. It could also have either switcher trucks or the Blombergs.

The NC&StL units were equipped with

LOUISVILLE & NASHVILLE: C. NORMAN BEASLEY

Plant 3's first production GP7's were six in maroon and gold for the Nashville, Chattanooga & St. Louis, equipped with switcher trucks. A year after the '57 L&N merger, two pushed a freight up Cumberland Mountain.

24RL air brakes and the switcher truck, while the second order, 10 GP7L's (a differentiation soon dropped) for the Frisco, had the standard Blomberg truck and 6BL brake equipment. Only one other order was produced with the switcher trucks, 30 GP7's for the Army in 1952, but use of the 6BL air-brake system was common. Seven GP7's were built in January 1950, but by year's end the shop was shipping more than 40 a month. Production increased throughout the year as EMD struggled to meet the surge in orders.

Cleveland's locomotive production grew at a rapid rate, reaching two switchers and two GP7's a day by October 1950. Employment kept pace, and by fall 1950, 2,100 people were employed in the facility and the floor space being used had grown to 527,735 square feet. The 936 units produced in 1950, 558 switchers and 378 GP7's, made Plant 3 the second-largest locomotive manufacturing facility in America, behind Plant 1. Between 1948 and 1953, orders were so high that even Alco lost business owing to its inability to make prompt deliveries. The decision to acquire Plant 3 was proving worthwhile and profitable for EMD.

Production totals for 1950 reveal that 436 SW7's were constructed at Cleveland, along with 18 similar units constituting 9 TR4 sets, the catalog successor to the TR2. In addition to the GP7, two other new models went into production in 1950. In September, the 800 h.p. SW8 was added to the catalog, with 23 units produced. In November, a single SW9 left the shop for the Chattanooga Traction Co., a Southern subsidiary. Two prototype SW8's built at La Grange were among the handful of non-Cleveland switchers built during this period. The SW9 was an upgrade to the SW7, retaining the 1,200 h.p. rating. Several customers received SW7's and SW9's in the same order, the primary difference being the diesel engine—the SW7 used a 567A and the SW9 a 567B.

Plant 3's totals for 1951 were slightly higher, 945 units, marking an all-time peak in production. The output consisted of 523 switchers and 422 GP7's, which was rapidly becoming the industry choice for a road-switcher. The Cleveland

# EMD's northern satellite plant

JAMES A. BROWN

London-built: An FP9-F7B duo hustles Canadian Pacific train 1, the *Canadian*, westward near Blackburn, Ont., on August 2, 1962.

**Cleveland wasn't EMD's** only satellite locomotive assembly plant. Indeed, even as Plant 3 geared up for production in 1948, EMD was looking due north for its next major expansion.

Dieselization was gaining momentum in Canada. Alco's longtime Canadian affiliate, Montreal Locomotive Works, began constructing Alco-design diesels at its Montreal, Quebec, plant in 1948. That same year, Baldwin and Whitcomb began marketing their diesel wares in Canada through an alliance with the Canadian Locomotive Co. of Kingston, Ontario. (Few Baldwin and Whitcomb diesels were sold in Canada, and CLC's more lucrative deal to market and build Fairbanks-Morse-design diesels at its Kingston works took effect in 1950.) The Canadian market was too rich to ignore; EMD wanted in.

EMD first tapped the Canadian market in 1946-47 with the sale of a few NW2's to Canadian National and Toronto, Hamilton & Buffalo, followed by a half-dozen F3's to CN in 1948. EMD, with its U.S. plants producing to capacity and import duties complicating Canadian sales, went shopping for a suitable location to build a locomotive plant north of the border. The lads from La Grange found just what they were looking for on the east side of London, Ont., in a plot of farmland nestled between two main lines: Canadian Pacific's Toronto-Windsor route and CN's secondary Toronto-London line.

Officially known as General Motors Diesel Ltd. ("GMD"), EMD's London plant formally opened on August 11, 1950, and outshopped its first locomotives, TH&B GP7's 71-72, in two weeks.

London's order books were quickly filled. In its first year, the plant had turned out more than 130 units, from SW8's and 9's to GP7's, F7's, and FP7's. Canadian railways large and small—from giants CN and CP to regionals Algoma Central and Ontario Northland to short lines TH&B and Essex Terminal—lined up for London-built locomotives. Interestingly, one of GMD's largest first-year orders came from the Wabash, which took 4 SW8's, 1 GP7, and 20 F7A's to dieselize its Windsor-Buffalo operations. Chesapeake & Ohio, Great Northern, and New York Central also dieselized their Canadian operations with GMD units.

While London offered locomotives from the entire EMD catalog—as well as GMD-only models such as B-B and A1A-A1A-trucked GMD1 road-switchers—several EMD models are absent from its production lists, notably E units and first-generation SD types. CP's three E8's, delivered from La Grange in 1949 for Montreal-Boston pool service with Boston & Maine, were the only E's on a Canadian railway, and London didn't build an SD until its first SD40's in 1966.

Nevertheless, London in the 1950's had all the business it could handle. Export locomotives for overseas customers were added in 1953, and by '54, GMD's locomotive production had surpassed 500. In 1957, GMD marked completion of its 1,000th unit, a CN SW1200.

By fall 1960, London had built more than 1,800 locomotives and helped deliver the *coup de grace* to Canadian steam when it outshopped its last steam-killing order, 25 SW1200's for CP. Still small enough to fit in the parking lot at La Grange, the compact London facility had even greater victories ahead.—*Greg McDonnell*

operation was playing a more significant role in dieselizing America's railroads than envisioned. Instead of filling yards with switchers, Plant 3 was also playing a crucial role in maintaining EMD's dominance in road locomotives with the GP7. Plant 3's 945 units of 1951 accounted for almost 40 percent of EMD's total production of 2,375 units for the year. Production of the SW7 ended in January, with 35 units shipped, and the new SW9 took over as Cleveland produced 304 throughout 1951, as well as 85 of the new SW8.

An interesting aspect of Plant 3's 1951 production was that almost 20 percent of its output, 185 units, went to a single customer, Atlantic Coast Line, which accepted 64 SW9's and 121 GP7's. The 5,600-mile ACL, in fact, was one of two mid-size systems to go a long way toward total dieselizaton with Cleveland units. ACL and subsidiary Charleston & Western Carolina received 175 GP7's from May 1950 through December 1951, and totally dieselized in 1955. Another big customer was the 4,900-mile St. Louis-San Francisco ("Frisco"), which from February '50 through December '51 got 106 GP7's and 5 SW7's from Plant 3, and dieselized on February 29, 1952. Neither the Coast Line nor the Frisco bought any new GP9's.

In 1952 Cleveland production dipped to 724 locomotives, owing to a recession and a softening in demand for diesels, but for the first time, GP7's dominated the shipments, with 381 going out versus 343 switchers. The 30 Army GP7's, some of which wound up on the Alaska Railroad, were among the units shipped, as were four SW8's for Lehigh Valley equipped with dynamic brakes, rare on switchers.

## THE EXPECTED, INEVITABLE DECLINE

Cleveland's fortunes began a downward spiral in 1953. Many railroads were mostly dieselized, and low traffic levels allowed them to postpone buying more units. Total diesel orders fell from more than 4,000 units in 1950 to 1,800 in 1953. Even though EMD's market share was

STEVE PATTERSON

**Cleveland oddity: The only GP7 on the entire SP system was No. 304 of subsidiary Cotton Belt, built as a passenger unit but working a local freight at Camden, Ark., June 16, 1962.**

still growing, its anticipated glut in production capacity was starting to come true. Production at Plant 3 fell to 482 units, 335 switchers and 147 GP7's.

The dramatic decline in Cleveland GP7 production was the result of most orders being assigned to La Grange, which had room in its production schedules. This led to large layoffs at Plant 3, including 422 employees on May 29. Another big group was gone before August. Production began to wind down, and it was apparent the Cleveland plant's days were numbered. By year's end, its production had been cut 60 percent.

EMD tried to find other uses for the facility, and one attempt involved building piggyback flatcars. A 71-foot-long prototype with a depressed, well-like bed was built, designed to haul full-sized truck trailers in spots with low, 15-foot clearances. If the plan succeeded, the shop could make eight cars a day on two shifts. Alas, little came of the project, as EMD was a heavy industrial concern that could not compete in what was essentially a welding-shop market because its labor costs were too high. Efforts were also made to have Plant 3 produce components for La Grange that formerly came from outside suppliers. Fuel and water tanks, brake and cooling hatches, and other metal fabrications were being made in Cleveland, but this wasn't enough to keep the doors open.

At the start of 1954, EMD revamped its catalog again and introduced the SW600, SW900, and SW1200, numbered by horsepower, to replace earlier switcher models. Plant 3's production of this line would be brief, though, as things changed quickly. The market for new units plummeted to fewer than 1,000 per year from all builders. Since this was less than La Grange's capacity alone, there was little need for the Cleveland plant. As a result, it built only 31 switchers from January through April before it ceased locomotive production. The final units to leave Plant 3's gates were two SW900's for Southern Pacific, Nos. 4624 and 4625, which headed west in April. The plant was officially closed on October 1, 1954.

The facility was subsequently occupied by GM's Euclid Road Machinery Division, which later became Terex. Cleveland Diesel was merged into EMD in 1962 and closed down, severing the builder's final ties to its namesake city. Terex eventually moved out, and the plant became a warehouse complex. What was briefly the second-largest diesel-electric locomotive production facility in America has virtually passed from memory. ■

BUILDER PROFILES

# Fairbanks

## A unique power plant was at the heart of a family of innovative diesels

BY **GREG McDONNELL**

Fairbanks-Morse was no stranger to railroading, or to diesels, when Milwaukee Road 1,000 h.p. switcher 1802, the first FM-built locomotive, burst through a ceremonial paper banner at the Beloit, Wis., plant on August 8, 1944. FM had been supplying the railroad industry with everything from handcars and scales to water tanks and standpipes since the late 1830's, and had been working with gasoline and diesel engines for stationary and marine applications since before World War I.

In the early 1930's, the same U.S. Navy submarine program that inspired development of the Winton 201A and the Cooper-Bessemer FW engine (an ancestor of the General Electric FDL), led FM to design its signature power plant, the two-cycle, opposed-piston diesel.

Meanwhile, Fairbanks-Morse tested the waters of the railroad diesel business, supplying a limited number of its pre-OP engines for use in railcars, as well as the first FM-powered diesel locomotive. This was Reading 35, a 600 h.p. center-cab powered by a pair of 8-cylinder, in-line FM diesels, put together by St. Louis Car in 1939. FM had its eye on the locomotive market, and if the early efforts proved anything, it was that FM's fortunes would be best served by the opposed-piston diesel.

The OP hit the rails in 1939, powering six shovel-nosed railcars built by St. Louis Car for the Southern Railway. FM reportedly had a 2,000 h.p. cab unit and a 1,000 h.p. switcher on the drawing board by 1940, but the Navy conscripted the OP, requisitioning all Beloit diesel production for use in submarines. As the OP went to war, FM's locomotive plans were put on hold.

In 1943, FM got a green light to resume locomotive development, and Beloit tooled up to enter the market. In the months following the August 1944 unveiling of Milwaukee 1802, locomotive production at Beloit was

# -Morse

## A supplier's bid for the big time

WILLIS McCALEB PHOTO; KRAMBLES-PETERSON ARCHIVE

**Sold! Gleaming at Decatur, Ill., in 1954, FM demos TM-1 and TM-2 have just become Wabash 550 and 551, first of the road's eight dual-service Train Masters.**

limited, in part by wartime restrictions. By May 1945, three more of the high-hood-style switchers, later tagged in FM parlance as H10-44's, had emerged from Beloit, one each for Chicago & North Western, Santa Fe, and Union Pacific. Milwaukee had 10 more on order, and FM's long-awaited road diesel was on the way.

Owing to space and capacity restrictions at Beloit, FM contracted with General Electric to assemble the 2,000 h.p. cab and booster units at GE's Erie, Pa., works. Dubbed "Erie-builts," the big dual-service units, with sleek Raymond Loewy-styled carbodies, 10-cylinder OP's, and A1A-A1A trucks, debuted as an A-B-A set for Union Pacific in December 1945.

Although FM's original contract with GE called for 30 of the units to be built at Erie, a total of 111 (82 A's and 29 B's) were completed before the model was discontinued in February 1949. The Erie helped FM get its foot in the door of roundhouses and diesel shops nationwide, recording sales to Santa Fe, C&NW, Kansas City Southern, Milwaukee, NYC, Pennsy, and UP. Santa Fe got just one A-B-A set, while Pennsy had the most, 48. North Western took four A units, and KCS got three A-B-A trios for freight service.

Probably the Eries' brightest spotlight was on the Milwaukee, where 10 cabs and 5 boosters initially worked the highly publicized Chicago-Tacoma *Olympian Hiawatha* without change. They were decked out with fluted stainless steel trim to match the train's streamlined equipment. If you suspect a trend with the Milwaukee, you're right—it was in some ways FM's best customer, and since it served the Beloit plant, also had a pact with FM to use the old "Southwestern" line through town as a test track.

The Beloit plant, meanwhile, was bursting at the seams as the postwar diesel boom heated up. In 1947, FM bolstered its catalog with a 1,500 h.p. road-switcher and a "Heavy Duty" locomotive, a 2,000 h.p. end-cab design that acquired the designation H20-44. Although FM lagged behind EMD, Alco, and Baldwin in sales, the Wisconsin builder had all the business it could handle, and it all but totally dieselized three small Class 1's (Akron, Canton & Youngstown; Pittsburgh & West Virginia; and Virginian).

Completion of new locomotive facilities at the Beloit plant in 1948 gave FM more production capacity, and licensing the

BARNEY L. STONE PHOTO, KRAMBLES-PETERSON ARCHIVE

Milwaukee Road Erie-built 22A is at Milwaukee with nameless Green Bay-Chicago train 10. Loyal customer MILW used FM switchers into the early 1980's.

Its high hood covering the tall FM opposed-piston engine, sharp-looking Kentucky & Indiana Terminal H12-44 No. 61 stands at Louisville in 1964.

manufacture of the OP engine and FM locomotive designs to Canadian Locomotive Co. of Kingston, Ontario, gave FM an international presence.

Riding high in 1948, FM announced its "Consolidation" line of freight and passenger units, available in cab and booster versions rated at 1,600, 2,000 and 2,400 h.p., and cataloged in 14 models with B-B and B-A1A wheel arrangements ["A New Dress for Opposed Pistons," Spring 2005 CLASSIC TRAINS].

New York Central ordered, sight unseen, eight 2,000 h.p. CFA20-4's, and FM dispatched two 2,400 h.p., B-A1A CPA24-5 demonstrators on a nationwide tour in spring 1950. Despite FM's enthusiasm, C-Line sales were disappointing, amounting to just 165 units in the U.S. and Canada. Part of the blame was timing—the cab unit was rapidly losing ground to the road-switcher. But also, FM's reputation had been damaged by early problems with its opposed-piston diesel ["Why the C-Line Fell on its Face," Spring 2005 CLASSIC TRAINS].

Undaunted, FM forged onward, upping the output of its switcher line to 1,200 h.p., boosting its road-switcher rating to 1,600 h.p., and adding a six-motor version to the lineup in 1951. But the builder's best was yet to come.

In 1953, FM unveiled the Train Master, a 2,400 h.p., C-C unit, model H24-66, capable of hauling passengers or freight and pitched as "the most useful locomotive ever built." The most powerful single-engined diesel of its day, the Train Master acquitted itself well.

Lackawanna ordered 10 Train Masters before the first of four demonstrators was even built, and returned later for two more. Reading Co. signed up for nine on the merits of two demonstrators on display at the Railway Supply Manufacturers Association exhibit in Atlantic City, N.J., in June 1953. Barnstorming nationwide, four red-and-yellow TM demos came back to Beloit with enough orders to help FM overtake Baldwin as the No. 3 builder, albeit with just under 7 percent of the market share, for 1953.

"The Mr. Big of road-switchers," the Train Master could wheel passengers at 80 mph, work time freights, lug coal drags, shove hump cuts, shoulder helper duty, and endure the start-and-stop rigors of suburban commuter service.

The Train Master bumped Mallets from coal drags and mine runs on the Virginian, and after an ill-fated period in the New Mexico desert on SP, proved themselves perfect for commute service, banishing 4-8-2's and 4-8-4's from the start-and-stop San Francisco Peninsula duty. Jersey Central employed them in the same

J. DAVID INGLES

service, and they worked as helpers and on humps and drags on the Pennsy; pulled passengers, spliced F7's on freights, and labored on locals for the Wabash; lugged tonnage on Southern's Rat Hole; and handled hotshots and passenger trains with aplomb for the Reading and the Lackawanna, doubling as helpers for the latter on Scranton layovers.

What the Train Master couldn't do, though, was pull FM from the doldrums. "Mr. Big" was ahead of its time in horsepower, but too late in dieselization's first round to score big sales. In four years, the model sold only 127 units to eight U.S. and the two big Canadian roads. FM was struggling when Virginian received the last 7 in 1957. Earlier problems with the OP and electrical systems mostly had been resolved, and FM's switcher line did well (535 units to more than 30 buyers into 1958), but the diesel market was drying up, and FM's domestic sales for the year totaled only 46 units.

Four oddballs—lightweight, 1,200 h.p. P12-42 models, one unit for each end of two experimental ACF Talgo trains for Boston & Maine and New Haven—were among just 15 locomotives FM built in 1958. That October, just over 14 years after Milwaukee 1802 burst triumphantly through the banner, Beloit quietly finished its last domestic diesel, Tennessee Valley Authority H16-66 No. 24. Orders trickled in from Mexico's Chihuahua Pacific until March 1963, when FM finished its very last locomotives, CHP H16-44's 603 and 604. ■

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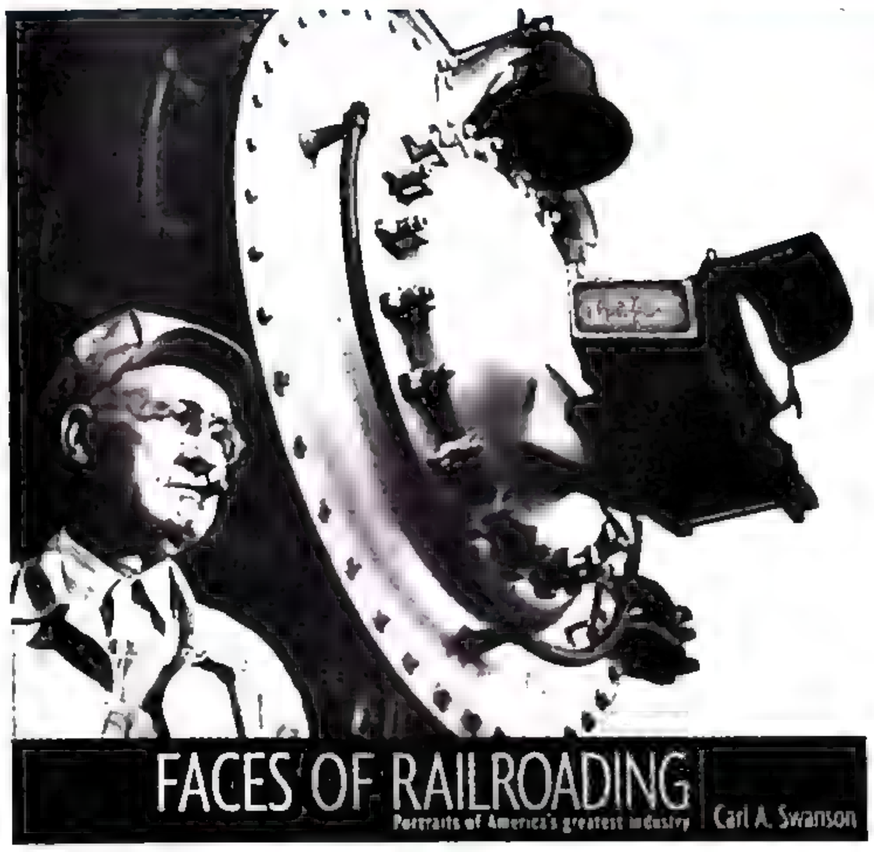


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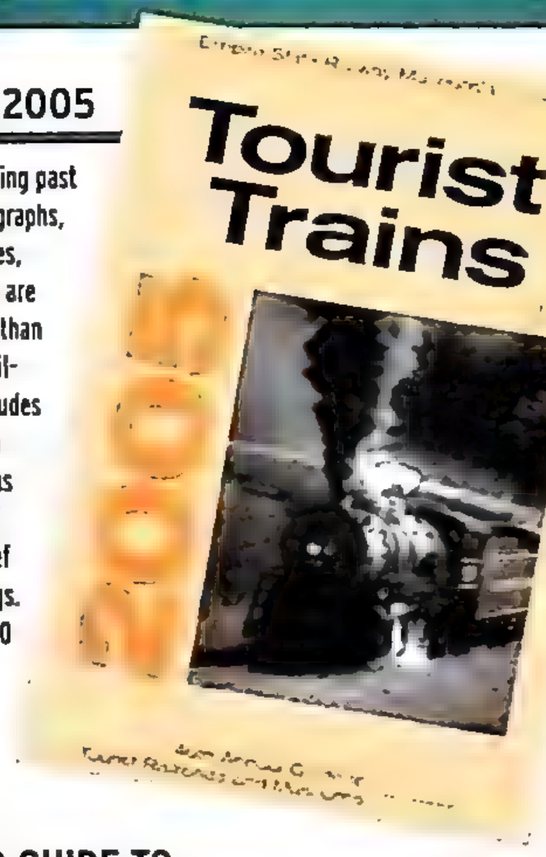

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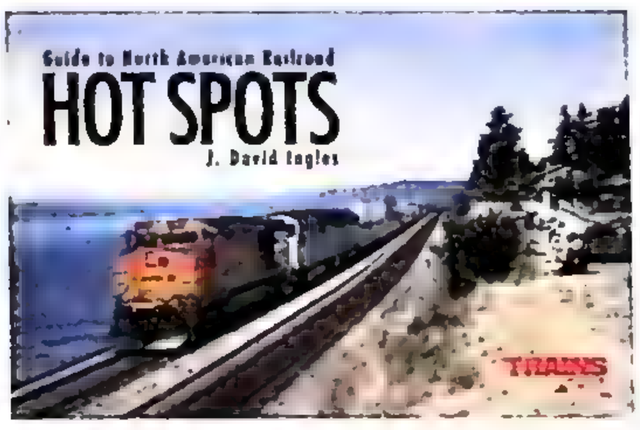


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## Diesel Victory

# Photo section

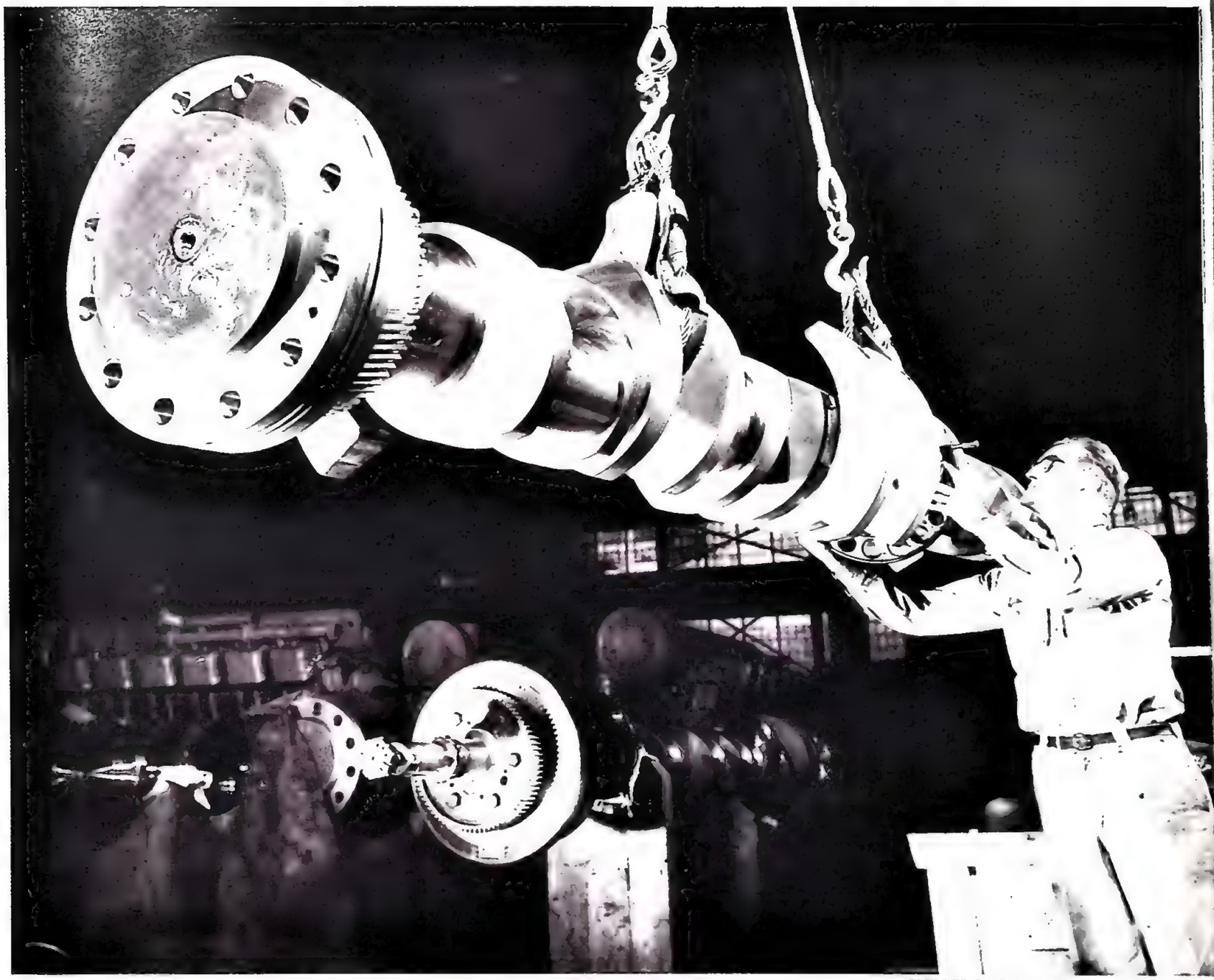
GEORGE SPEIR

Railroads without flashy streamliners or that dieselized late relied on road-switchers as well as cab units for passenger power. Soo Line, whose 18-car *Laker* was at Forest Park, Ill., in August 1958 on the last leg into Chicago behind GP9's 2556 and 2554 and FP7 2501B, had 14 dual-service F units and 12 such GP9's. The Geeps' four-digit numbers indicate ownership by subsidiary Wisconsin Central Railway (merged in 1961).

J. DAVID INGLES COLLECTION

Alco RS3 road-switchers generally were set up to operate long-hood forward, but they could be smoky, and crews preferred 'em the other way. Among the short-end-first crowd were Milwaukee Road and Northern Pacific, 2 of whose 14 RS's sandwiched a GP9 at Duluth, Minn., in August '64.

SANTA FE



OPPOSITE: SANTA FE; ABOVE: ALCO

The diesel could be a dramatic subject for publicity carmeras. In a starkly lit composition from early 1956 (above), an Alco shop technician checks a connecting-rod bearing on a gleaming new crankshaft ready for installation in a 251 engine.

A scene set up more for drama than safety has a foreman standing in a doorway signaling a hostler to bring an E3 or E6 onto a pit from which an inspector seems to be exiting. The location is 21st Street, Chicago, where Santa Fe established the nation's first purpose-built diesel running-repair shop. Visors on lights were a wartime requirement for engines operating on the Pacific Coast—impossibly far away for steam, but a routine run for ATSF diesels.

DAN PETERSON

Freight cab units that followed the FT helped make EMD's "bulldog" nose the most famous face in dieseldom, and the eastbound F3's passing a steam-powered freight on Sherman Hill on September 14, 1952, are worthy of the Union Pacific shield affixed to 1418's nose.

LOUIS A. MARRE; J. DAVID INGLES COLLECTION

Alco's 1,500/1,600 h.p. FA's and FB's, 1,400 strong, went to 25 U.S. roads. Missouri Pacific's 147 included both versions, attested by a set at North Little Rock, Ark., in 1961. When replacement time came in '62, MP sent 100 to EMD for GP18's, which used the Alco trucks.

J. DAVID INGLES

Baldwin's few "Babyface" freighters weren't nearly as distinctive as its 232 later "Sharknose" units, 85 percent of which went to Pennsy and NYC (EJ&E took four, B&O the rest). A Central trio shows off "lightning-stripe teeth" while resting at West Detroit, Mich., in 1961.

Western railroads, with their long runs, often through dry country, clamored for the FT, and the Rio Grande was among them, with 12 A-B-B-A quartets. In its original black and yellow, a four-unit Rio Grande set rolls a freight west up Tennessee Pass near Granite, Colo., on April 16, 1949.

JACK THODE

GEORGE KRAMBLES, KRAMBLES-PETERSON ARCHIVE

Electro-Motive's 600 h.p. SW1 was a long-lived goat, built 1939-53 (with a war interruption) for 33 Class 1's (71 percent of the 661 units) and 50-plus short lines and industrials. In 1953, No. 9019, one of Illinois Central's 19, drills the coach yard at Central Station, Chicago.

BARNEY L. STONE; KRAMBLES-PETERSON ARCHIVE

Talk about your minorities! Like many roads, Rio Grande sampled Baldwin switchers out of necessity, while the Western Pacific 4-8-4 that 1941 VO660 No. 68 (one of nine) is hostling in Salt Lake City in 1948 was one of six Limas patterned after SP's *Daylight* engines.

J. DAVID INGLES

Alco sold 177 "high hood" switchers of five types to 24 Class 1's and 20 other buyers during 1931-40 before reversing the arrangement of radiator and engine room for its "S" line. Santa Fe 2311 takes on sand at Redondo Junction roundhouse in L.A. in 1964.

SHELBY LOWE

The 539-engined S1 was the successor to Alco's "high hood" switchers. In a rare April 1947 photo, Nashville, Chattanooga & St. Louis No. 1 (later Louisville & Nashville No. 57) shows off its early solid-maroon livery and "To and from Dixieland" cabside slogan.

A. STYFFE; KRAMBLES-PETERSON ARCHIVE

In December 1958, Southern Pacific 4619, a Cleveland-built EMD SW8 complete with very un-switcher-like gyrating warning lights and "road engine" number boards, is on a former Pacific Electric line at El Monte, Calif., between Los Angeles and San Bernardino.

Three generations: In a splendid example of steam-plus-diesel power, with a significant historic twist, an EMC duo of a 1937 EA and a 1935 box-cab doublehead with an Alton Railroad 4-6-2 as they storm through the north side of Springfield, Ill., circa 1940 with the St. Louis-Chicago *Abraham Lincoln*. The Alton was owned by the B&O, which sent to its stepchild EA 52, built for the *Royal Blue*, and then box-cab 50. To form a "single locomotive," Alton applied the number 50 to both units. The box-cab served on Alton and successor GM&O (as No. 1200) into the 1950's and is preserved (as B&O); the EA, by then GM&O 100A, was rebuilt to an E8M in 1953 and worked into the Amtrak era, but was cut up.

WALTER A. PETERS

JOHN DZIOBKO

When Great Northern found that its EMD E7's had trouble getting the *Empire Builder* up mountain grades, the road bought passenger-equipped F7's, which had all their weight on drivers. An A-B-B-A F7 set heads up the *Builder* at Havre, Mont., in September '57.

RAY MUELLER

Kansas City Southern E3 No. 23, pictured at the road's Beaumont, Texas, depot in August 1948, still looks fresh in the *Southern Belle* livery she and two sister E3's introduced to KCS in 1940. Electro-Motive built 16 E3A's and 2 B's for eight railroads during 1939-40.

K. D. KING JR.; DAN POPE COLLECTION

THOMAS J. McNAMARA

Alco built 78 DL109-family diesels during 1940-45; the New Haven got 60, keeping EMD E units off the passenger-heavy carrier. In 1956, before NH's 109's succumbed to varnish reductions and dual-power EMD FL9's, No. 0755 speeds a train along the Old Colony in Massachusetts.

In a 1956 scene at the engine terminal near Central Station in Houston, Texas, Santa Fe PA1 73 and Missouri Pacific E7 7011 cool their heels between passenger runs. Although the E7 outsold the PA1 by 2.5 to 1, only one E7 remains (PRR 5901, at Strasburg, Pa.), vs. four PA's (all ex-Santa Fe via D&H—two in Mexico and two in the U.S.).

BUILDER PROFILES

# Lima

J. DAVID INGLES

## The last true steam believer lasted less than three years as a diesel builder

BY **GREG McDONNELL**

Lima, the youngest and smallest of the Big Three steam builders, was synonymous with steam at its best, and it upheld the steam standard to the bitter end. Even as legions of steam-killing diesels were rolling off the erecting floors of five competitors, Lima Locomotive Works was espousing the advantages of modern steam power from its hometown of Lima, Ohio.

Even amid the postwar dieselization boom, while EMD engineers scrutinized designs to hone the best-selling F3 into the better-selling F7, Lima men pored over the blueprints of a proposed double-Belpaire boiler, poppet-valve 4-8-6 they hoped would be the salvation of big steam. Designed to match diesel operating costs and availability, the 4-8-6 remained on Lima's books as late as 1949, but never achieved reality.

Lima's devotion to steam cost it dearly. While competitors' books bulged with diesel orders, Lima went hungry as steam orders dwindled. Being careful not to concede defeat or publicly compromise its steam loyalty, Lima merged with the General Machinery Corp., of Hamilton, Ohio, to form the Lima-Hamilton Corp. on October 1, 1947. Having spurned a postwar proposal to produce diesel locomotives for Fairbanks-Morse, Lima was neither shopping for a diesel-building partner nor looking to head to the altar. Rather, the L-H marriage was instigated by General Machinery, which was in search of a postwar market for its Hamilton diesels as well as a gas turbine already under development.

Although Lima had built a few diminutive gas-mechanical locomotives in the 1920's and '30's, the company had virtually no experience with diesels. Meanwhile, General Machinery's 4-cycle Hamilton diesel, based on German MAN designs, had been introduced in 1936 and seen use in marine, industrial, and stationary applications. Hamilton diesels also had been employed in experimental locomotives built by Davenport and Plymouth, and to repower distillate and gas-electric motor cars.

As steam production at Lima plummeted, engineers at the Hamilton, Ohio, plant, 105 miles

# Last in, first to leave

JOHN S. INGLES; J. DAVID INGLES COLLECTION

**PRR transfer unit 5673, seen at Columbus, Ohio, in 1959, was from the last batch of locomotives built at Lima. Inside each hood was a 1,250 h.p. engine.**

**Switchers accounted for 78 percent of Lima's diesel production. CUT 23 (750 h.p., on lease to B&O) and B&O 9385 (1,000) are at Cincinnati in late 1965.**

south on the B&O, worked to design an engine based on the proven Hamilton 68SA. In 1948, diamond-shaped Lima builder's plates, appended with the words LIMA-HAMILTON CORPORATION, were affixed to just 36 steam locomotives, including 20 for coal-hauler Chesapeake & Ohio. In 1949, Lima had just two orders on the books, both for 2-8-4 Berkshires (10 for Louisville & Nashville, 22 for Nickel Plate Road).

The Berks weren't the only locomotives taking shape at Lima, however. In spring 1949, a single diesel switcher with an 8-cylinder Hamilton T89SA engine and Westinghouse electrical gear was nearing completion in the Tank Shop. Finished on May 12, 1949, Lima's first diesel, 1,000 h.p. demonstrator No. 1000, wore solid black paint with simple LIMA-HAMILTON lettering on its hood.

Ironically, just one day later, Nickel Plate 779 was fired up for final inspection. Overshadowed by the formal unveiling of Lima's first diesel, the 2-8-4 left the plant with little notice, just one more of the 7,548 steam locomotives built by the works. History would prove her to be the last, however.

"We firmly believe that for a long, long time, there will continue to be a demand for steam locomotives," read a Lima advertisement carried that same month in TRAINS magazine. But it was not to be. Lima 1000, the first of five 1,000 h.p. switcher demos, ventured into a diesel-hungry world. The newest model on the market was attracting interest, and orders. Armco Steel 708, the first diesel Lima sold, was delivered June 27, 1949. Two days later, Lima shipped its first common-carrier diesel as NKP 305 followed demo 1000 out the gates.

By April 1950, Lima had built 38 1,000 h.p. switchers including 4 for NKP, 6 for New York Central, and 10 each for Erie and B&O. Toledo, Peoria & Western bought a single new switcher, plus demos 1000 and 1004, while Armco took demo 1001 and a second new unit.

In fall 1949, Lima added a 750 h.p. switcher to its lineup. Housed in the same carbody as its 1,000 h.p. big brother, it was powered by a 6-cylinder T69SA engine and, like all Lima diesels, outfitted with Westinghouse electrical equipment. Only six were built, all for Cincinnati Union Terminal, between November 1949 and June '51.

Less than a year after building its first diesel, Lima expanded its catalog with a new line of 10 models in April 1950. Unlike other builders, Lima never assigned formal model designations to its diesels, referring to them simply by horsepower rating and configuration. Based on the 6- and 8-cylinder Hamilton engines, the new line ranged from 800 and 1,200 h.p. switchers to a 1,200 h.p. road-switcher and double-engine, center-cab transfer locomotives available in 1,600 and 2,400 h.p., C-C or A1A-A1A, versions. All had standardized components.

Although only 4 of the 10 models were ever built, Lima gained momentum through 1950 and early '51. Switcher sales were reasonably brisk, with repeat orders from B&O, Erie, Nickel Plate, NYC (under the auspices of subsidiary Chicago River & Indiana) and Armco Steel. Lima broke new ground with orders from Rock Island, the Terminal Railroad Association of St. Louis, New Haven, and Wabash, which augmented the purchase of 10 new 1,200 h.p. switchers by acquiring demos 1002 and 1003.

Road-switcher sales were limited to 16 steam-generator-equipped 1,200 h.p. versions for NYC, and Pennsy purchased the only 22 Lima center-cab transfer locomotives. Rated at 2,500 h.p. and riding C-C trucks, some of these units had m.u., cab signals, trainphone, and dynamic brakes.

While gruff-sounding Hamilton diesels talked it up on the Lima test track, company officials were engaged in quiet conversation with their counterparts at Baldwin. Shock waves rolled through the Lima works as news of a merger of Lima-Hamilton and Baldwin Locomotive Works was formally announced. On November 30, 1950, they became the Baldwin-Lima-Hamilton Corp.

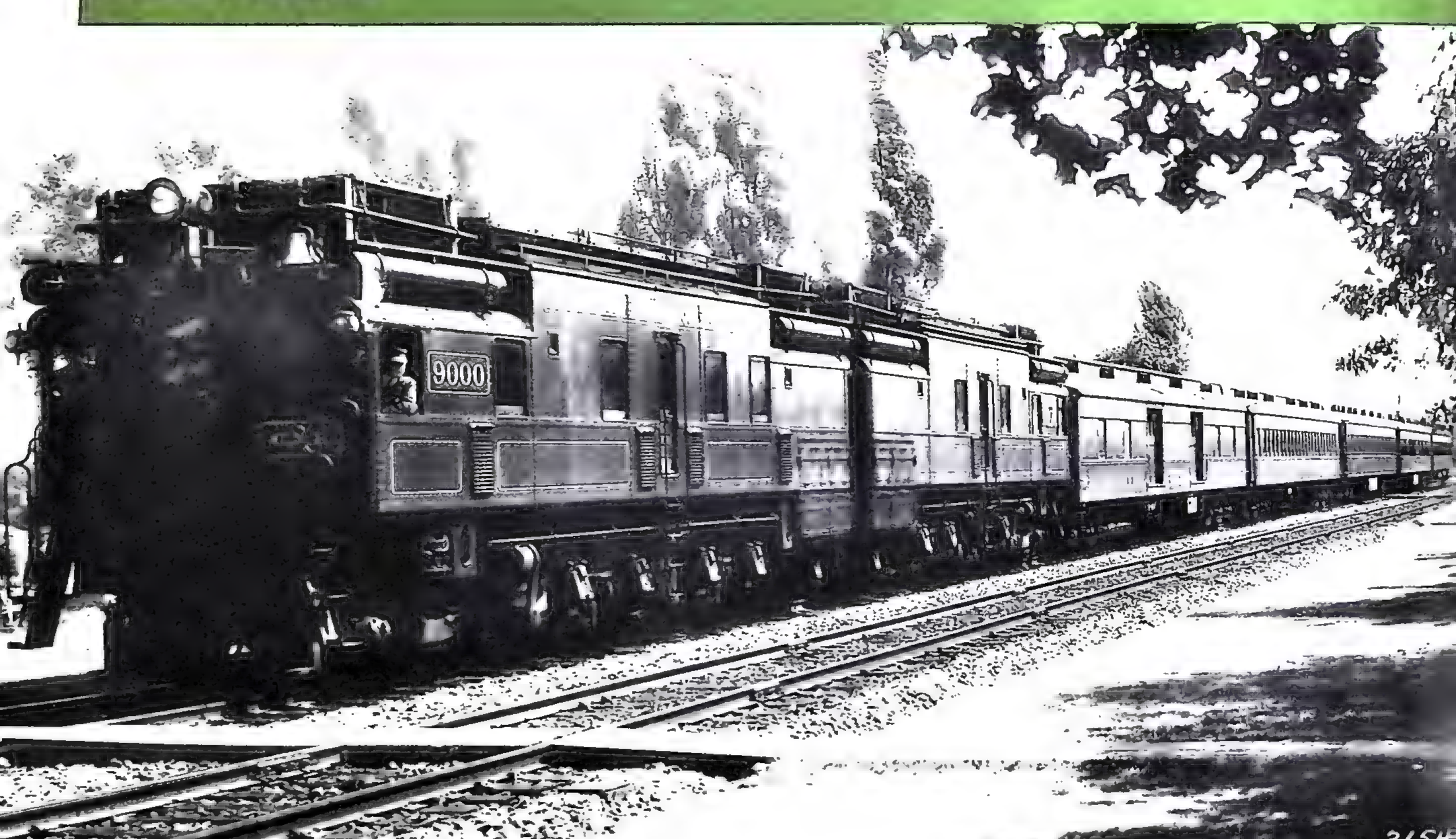
Baldwin wanted Lima not for its locomotive business, but for its non-rail product lines. With competition in the locomotive market heating up and demand cooling, Baldwin was looking to diversify, and Lima's crane and shovel division and other industrial concerns were just the ticket. On the eve of construction of the Interstate highway system, BLH planned to drop Lima's locomotive line and expand its shovel and crane production.

On September 11, 1951, Lima employees lined up for a formal portrait with PRR transfer diesel 5683, the final locomotive built at the Lima works. Not three years after the completion of its first diesel locomotive, Lima's 174th would be its last. The last of the Big Three steam builders to enter the diesel market was the first to leave. ■

# Mr. Brooks and the Beardmores

## How Canadian National briefly led the way toward dieselization

BY KEVIN J. HOLLAND



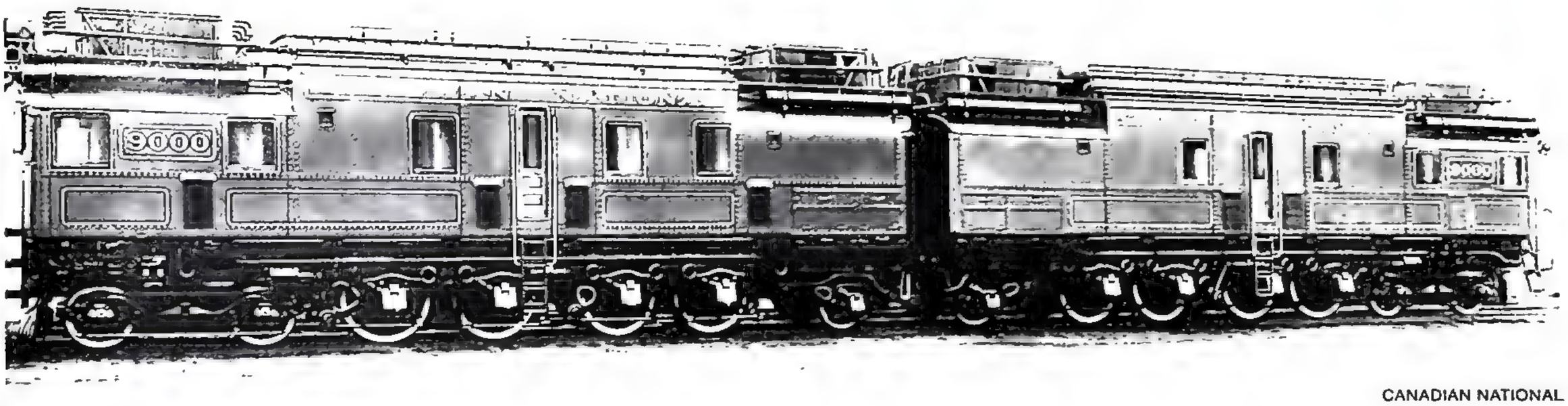

CANADIAN NATIONAL

The non-stop, 1,015-mile Denver-Chicago sprint of Burlington Route's *Zephyr* on May 26, 1934, with all its orchestration and melodrama, heralded the coming-of-age of internal-combustion powerplants in mainline railroad service in the United States. With the long-distance reliability and economy of diesel prime movers proven to all but the most entrenched skeptics, the names of diesel engine builders such as Winton and Macintosh & Seymour had become, by the late 1930's, the colloquial "writing on the wall" forecasting the steam locomotive's clouded future.

In Canada, however, a similar watershed event had occurred almost 10 years earlier. It was equally significant to the *Zephyr*'s run, though less glamorous, and presaged Canadian National Railways' pivotal—yet pre-empted—role at the fore of mainline dieselization in North America. Over an elapsed 72 hours during November 1-4, 1925 (67 hours in motion and 5 cumulative hours of service stops), CNR self-propelled diesel-electric passenger car No. 15820 traveled 2,937 record-setting transcontinental miles, from Montreal, Quebec, to Vancouver, British Columbia.

### THE SCOTTISH CONNECTION

Canadian National Railways, a post-World War I amalgamation of overextend-




CANADIAN NATIONAL

**Twin-unit CNR 9000 was North America's first practical diesel road locomotive. Baldwin, Westinghouse, Beardmore, and Canadian Locomotive Co. all collaborated with CNR to produce it, in 1928-29, with publicity photos (left) made in August '29.**

ed and undermaintained railroads, and a ward of the federal government, linked Canada's major industrial and agricultural centers, but for decades CNR also was obliged to serve uneconomic routes in the interests of political equanimity. Picking up on constituent Canadian Northern's fledgling efforts, Canadian National management embraced the self-propelled passenger car in hope of cutting costs and besting high-way competition on routes offering marginal traffic potential.

In 1922, consideration was given by CNR management to creating a twin-unit, diesel-electric-powered passenger trainset. Spurred by developments in Sweden, where diesels had found railroad applications as early as 1916, CNR's proposed rebuilding and powering of two existing coaches never left the drawing board, though.

Dispatched to Europe in late 1923 for first-hand exposure to propulsion applications that might be of value in CNR's mechanical cost-cutting, Chief of Motive Power Charles Edward "Ned" Brooks and other officers visited, as one of their last stops, the works of William Beardmore & Company in Glasgow, Scotland. Surmising that the lightweight diesel engines then being produced by Beardmore for airships would, with some alteration, also be suitable for railway use, Brooks and his colleagues arranged for the shipment of 14 engines to Canada.

Back in CNR's Montreal headquarters, Brooks oversaw the installation of a water-cooled, four-cylinder, 185 h.p. Beardmore diesel in each of seven new railcars. (Two additional articulated two-car units were powered by 320 h.p., eight-cylinder Beardmores.) Electrical equipment was provided by Westinghouse, General Electric, and GE affiliate British Thomson-Houston (BTH). Ottawa Car Manufacturing Co. fabricated the carbodies, with final assembly in mid-1925 by CNR at its Point St. Charles shops in Montreal.

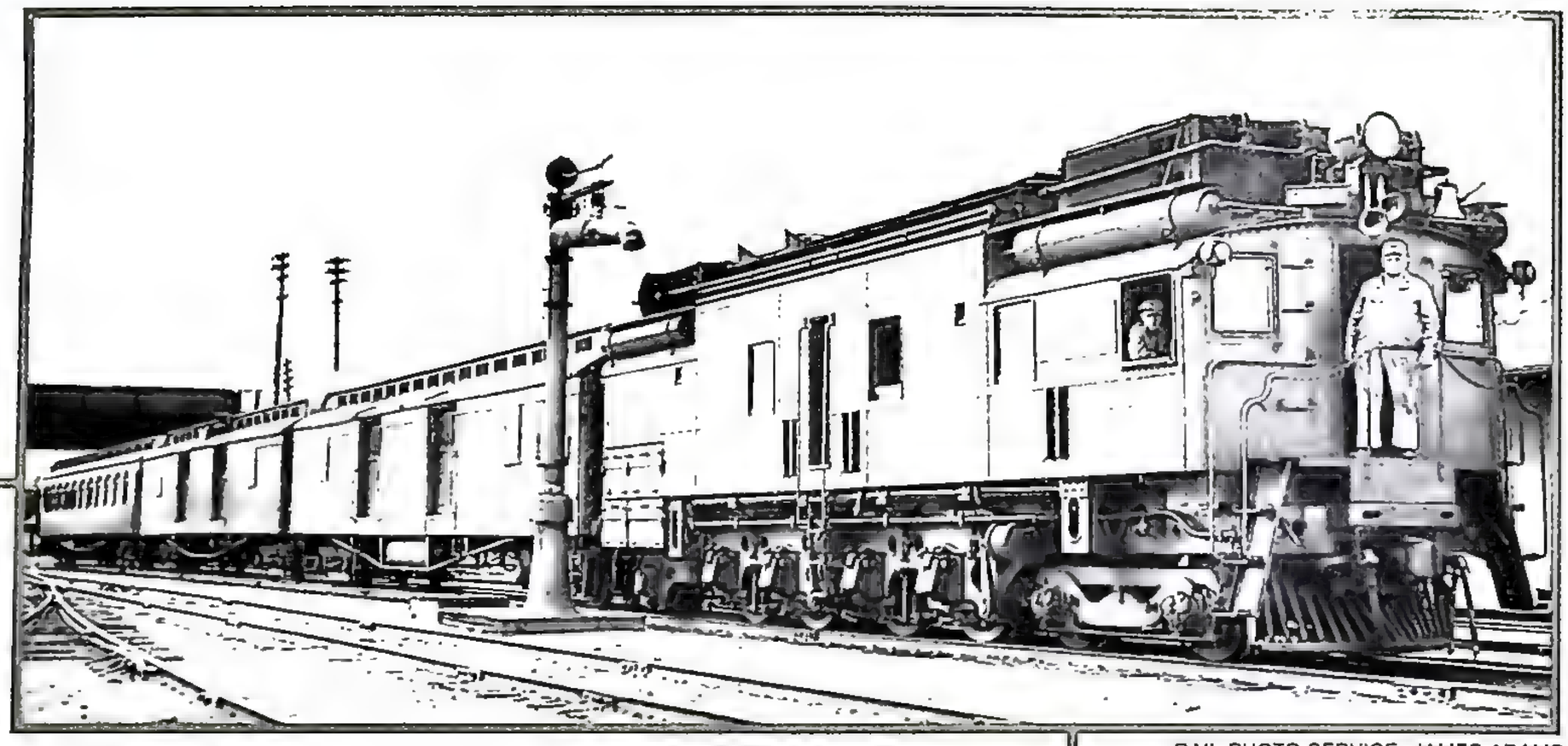
Self-propelled railcars were nothing new, of course. In the U.S., Electro-Motive Co. and St. Louis Car had entered the market the previous year with their gasoline-powered examples, competing with similarly fueled offerings from the likes of Brill and American Car & Foundry as well as earlier McKeen cars. A handful of gas-electric and storage-battery, self-propelled cars were already on the CNR roster in 1925, but Brooks—along with Sir Henry Thornton, the railway's chairman and president, and Operations Vice-President S. J. Hungerford—was anxious to evaluate these new diesel-electrics, the first such units in North America.

Having been pared of all unnecessary weight for its intended aerial service, the Beardmore design offered a more attractive horsepower-to-weight ratio than was previously available for railway service. The first completed CNR car, No. 15817, was kept "close to home" for its first month, assigned to Montreal-Ottawa service in late September 1925 before moving to southern Ontario in mid-October as additional cars entered service.

Car 15820 was pegged for assignment to British Columbia. Brooks was confident enough in the Beardmore engines' performance to send this car from Montreal to the Pacific coast under its own power, unassisted but closely monitored by on-board technicians. When Brooks' brainchild rolled to a stop at the end of its transcontinental trek on November 4, 1925, steam stalwarts no doubt looked on with a sudden apprehension.

CLASSIC TRAINS COLLECTION

**Ahead of the *Zephyr*: In November 1925, Canadian National self-propelled diesel-electric passenger car 15820 crossed Canada from coast to coast, covering 2,937 miles during 67 hours of operation.**



RAIL PHOTO SERVICE: JAMES ADAMS

AL PATERSON: PATERSON-GEORGE COLLECTION

The two units of CNR 9000 were separated in 1931 and operated that way, as 9000 and 9001, until October 1939. No. 9001 worked a three-car local out of Palmerston, Ont., in the late 1930's (above), and No. 9000 had Moncton-Quebec City train 51 on a roll (left) out of St. Foy, Que., on its overnight run's last leg.

## TWO FOR THE ROAD: CNR 9000

Ned Brooks' next application of a Beardmore prime mover yielded another, even more significant milestone: North America's first practical diesel-electric road locomotive. (New York Central No. 1550, a 750 h.p. box-cab delivered in June 1928 by diesel-switcher pioneers General Electric/ Alco/Ingersoll-Rand, while designed ostensibly for road service, spent most of its career handling local freight on Putnam Division branches.) Drawing upon influences as disparate as Baldwin's 1,000 h.p. demonstrator of 1926 and the 1,200 h.p. road units (the world's first) developed for Russian service in 1924, CNR's Brooks sought a high-horsepower locomotive (by mid-1920's standards) capable of maintaining mainline passenger-train speeds, but with sufficient tractive effort to be equally brawny in freight service.

As had been the case with his diesel-electric railcars, Brooks relied on a consortium of suppliers to create CNR's pioneering twin-unit road locomotive. Baldwin provid-ed designs for the two box-cab carbodies, Westinghouse the electrical equipment, and Beardmore a pair of 1,330 h.p., V-12 prime movers. Carbody fabrication and final assembly was undertaken at the Kingston (Ont.) works of the Canadian Locomotive Co. (CLC).

Riding on Commonwealth cast underframes with a 2-D-1 wheel arrangement (mimicking the 4-8-2 steam power recently built for CNR by CLC), each of the new locomotive's two identical units incorporated mechanical innovations not widely embraced by the industry at large until decades later:

- Radiators were cooled by electrically driven, thermostatic fans
- The main generator was isolated from the diesel engine in a "clean" enclosure, to reduce dirt infiltration
- Combustion air could be taken from outside or within the carbody, the latter providing a source of warmed air for more efficient winter operation
- To augment the on-board supply, provision was made for replenishing fuel, via self-contained pumps and plumbing, from a tank car in tow

As futuristic as the units were mechanically, however, they were, esthetically, creatures of the pre-streamlined "rivet-and-right-angles" era. Stepped rooflines matched contemporary passenger-car height at the ends of the units, surmounted by a clutter of radiators, air reservoirs, piping, and other appurtenances. The taller central portion of each carbody housed the Beardmore power plant.

Sharing CNR road number 9000, the two single-cab units were designed to be connected by a drawbar during in normal operation, although they entered service separately: the first in November 1928, followed by its identical mate (later

CANADIAN NATIONAL

**Still wearing its 1943 World War II armor for duty on a protective train that it never pulled in active service, CNR 9000 was back in regular use after the conflict, with a 1,440 h.p. EMD 567 engine replacing the original Beardmore prime mover.**

renumbered 9001) in April 1929.

Testing commenced soon after the first unit's delivery. On November 28, 1928, with Brooks' designated engineer, Herbert Palmer, at the controls, and CLC manager William Casey observing, an initial run between Kingston and Brockville, Ont., was followed by a trip to Montreal. The locomotive reached speeds of up to 65 mph despite a persistent air-brake problem traced to an improperly installed cutout cock. Overheated wheel bearings encountered on the Montreal run were remedied the next day, when Brooks calculated a redistribution of the unit's weight with the aid of track scales at Montreal Locomotive Works.

Canadian National headquarters and government officials were given an up-close look at the first unit during a Montreal-Ottawa foray soon thereafter. President Thornton got a bit too close, badly gashing his head on an underframe protrusion while climbing into the cab; his confidence in the new technology, however, was undiminished. Testing in freight service followed, with Montreal-Hamilton-Fort Erie, Ont., and Fort Erie- Burlington-Toronto trips revealing the ease with which the unit handled heavy tonnage under sometimes challenging circumstances.

On the return trip from Fort Erie to Toronto, a coupler knuckle failed in the consist of the coal train the unit was leading toward a short grade through Burlington. Engineer Palmer restarted the train without difficulty, both at that point and farther up the hill following an inspection stop made for the benefit of CNR and Westinghouse officials. A helper locomotive shadowing the test trips was never needed.

The units' various test outings garnered exposure in both the trade and popular press, and coverage mushroomed in the wake of No. 9000's first official run in its twin-unit configuration. On August 26, 1929, following a flurry of photographic activity near Montreal, the 9000 led the eight-car second section of train 15, the *International Limited*, one of CNR's premier passenger trains, on its 334-mile daylight run to Toronto. Following arrival at Union Station, the 94-foot-long, 334-ton, dark-green No. 9000 was put on public display at the Canadian National Exhibition (Canada's largest annual exposition, unaffiliated with the railway) just west of downtown.

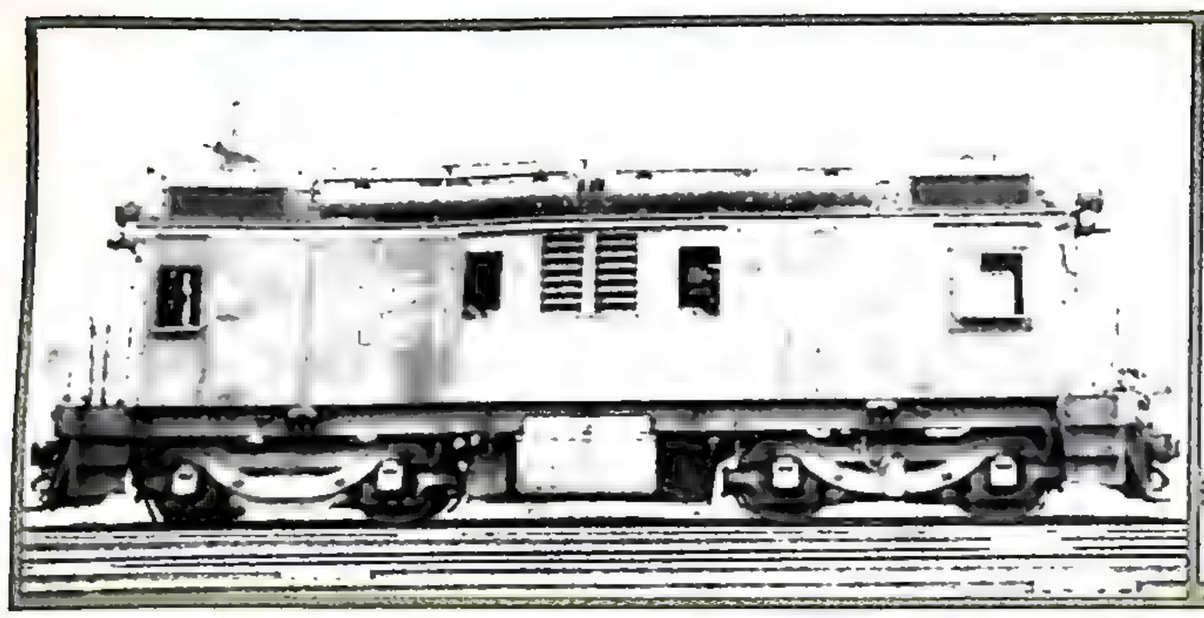
For the next two years, No. 9000 operated between Montreal and Toronto as a twin-unit locomotive, but not without teething pains. Metal fatigue, induced by vibration, was discovered in the engine blocks and generator shafts. The engines' lightweight aluminum pistons and steel cylinder linings proved a problematic match prone to seal failures, contributing to heavy oil consumption.

By and large, however, Brooks and his CNR superiors were pleased with 9000's performance, and in fact had already produced, with Westinghouse, another revolutionary, trend-setting diesel-electric locomotive: the first end-cab switcher.

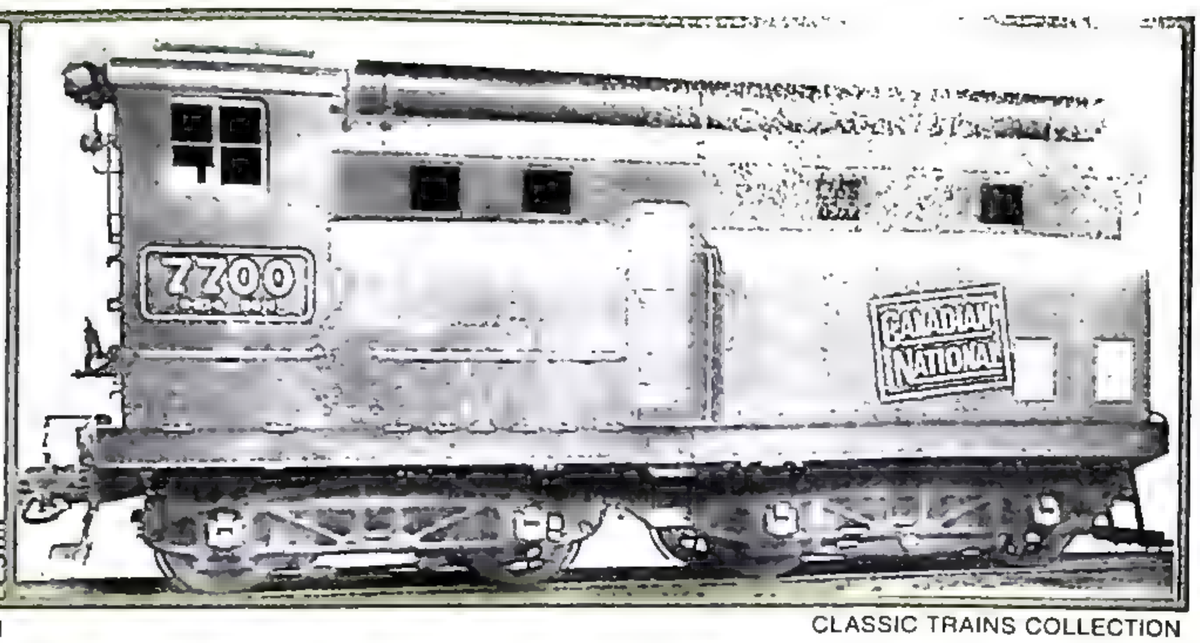
## IN THE YARD: CNR 7700 AND KIN

Prior to late 1929, the few dozen diesel-electrics employed in U.S. yard service were boxy affairs offering little in the way of bi-directional visibility, and with crews exposed to the noise, heat, dirt, and smell of the units' mechanical innards. Westinghouse sought to boost safety and efficiency by improving the sight lines and working conditions for to switching crews. The first locomotive to employ the revolutionary Westinghouse layout—dubbed the "visibility cab carbody"—was CNR No. 7700, powered by a six-cylinder, 400 h.p. Beardmore in-line engine (built by Westinghouse under license) and delivered from CLC in December 1929.

Measuring just an inch under 34 feet long, the stubby, black 71-ton unit featured a single operating cab offering lofty visibility to the rear and sides and, marginally, toward the front thanks to a narrowing of both sides of the upper carbody surrounding the engine. The B-B trucks of earlier box-cab switchers were retained, but the



LARRY RUSSELL COLLECTION




CLASSIC TRAINS COLLECTION

CNR 7700, delilvered by Westinghouse in late 1929, was its first end-cab diesel switcher. Box-cab 7750 (left) was assembled by CNR in 1932 from Ingersoll-Rand and General Electric components.

crew cab was isolated from the engine-room. Entering revenue service in spring 1930, No. 7700 soon became a fixture at Montreal's sprawling Turcot Yard, and later at smaller terminals in eastern Ontario.

A sibling, of sorts, for No. 7700 emerged from Point St. Charles shops in August 1932, assembled by CNR from Ingersoll-Rand and GE components. Dual 300 h.p. I-R diesel engines were housed in a box-cab carbody characteristic of the I-R yard units built in the U.S. since 1923; numbered 7750, CNR's fourth diesel-electric locomotive unit spent its career in the Montreal terminals.

## PROGRESS POSTPONED

By 1934, however, less than a decade after spearheading the introduction of diesel-electric locomotive technology to North America, Canadian National had all but abdicated its pre-eminent position in the field. The Depression—growing just as Nos. 9000 and 7700 were proving their worth—weighed heavily on CNR's traffic and finances, limiting the railway's ability to allocate funds to continued diesel research and development.

An ill-timed—but entirely accurate—proclamation by Mr. D. Crombie, CNR chief of transportation, in January 1931 didn't engender sympathy for dieselization among Depression-ravaged CNR workers and their elected representatives. Crombie postulated that widespread dieselization would save the costs and delays of steam-locomotive facilities, and "eliminate the utter waste of intermediate terminal locomotive houses, car inspectors, coal docks, water stations, yard tracks, and yard forces." With CNR a political football in a time of unprecedented economic and social hardship across Canada, statements like Crombie's could only set back the cause of CNR dieselization in the eyes of the railway's social overseers.

Against this backdrop, CNR president and dieselization supporter Sir Henry Thornton was preoccupied defending his personal and professional reputations against politically motivated attacks made by the newly elected federal government of Conservative Prime Minister R. B. Bennett. Thornton's forced resignation on August 1, 1932, left CNR in a state of upheaval, and the morale of its employees badly bruised. His health failing, within eight months Thornton died at age 61.

When the man at the vanguard of CNR dieselization, Ned Brooks, died of heart failure in early 1933 at age 46, the railway's progressive motive-power aspirations died with him. It would be another 15 years before CNR displayed any serious interest in mainline dieselization, under the post-war presidency of R. C. Vaughan and his 1950 successor, Donald Gordon. Even then, the old political demons of displaced labor and coal-mining interests, provoked by Crombie in 1931, were not easily overcome.

## SECONDHAND SENIORITY

While no new diesels followed No. 7750 onto the CNR roster until 1942, the railway's Midwestern U.S. subsidiary, Grand Trunk Western, acquired a handful of switchers during this interval. One of these, a secondhand 1934 arrival assigned GTW No. 7730, became by default the CNR system's oldest internal-combustion locomotive. A rare Brill gas-electric unit built as Long Island Rail Road No. 402 in January 1926, the 500 h.p. box-cab was converted to a diesel-electric by GTW in May 1939, employing a pair of Cummins engines. The unit was regularly assigned to switch the road's carferry terminal on the west shore of Lake Michigan in Milwaukee, Wis.

A pair of Electro-Motive SC-model units, delivered in April 1938 as GTW 7800 and 7801 (later 78 and 79—the Brill would become 73), became the CNR system's first production-line end-cab switchers. By this time, both EMC and Alco had embraced, and improved upon, the "visibility cab" layout pioneered by Westinghouse with CNR 7700.

## WAR DUTY

The two units of CNR locomotive 9000 were separated in 1931, and then operated independently, as Nos. 9000 and 9001, until October 1939. By that time, Canada was embroiled in World War II, and as the threat from Japan escalated over the ensuing two years, so did concerns over the possibility of Japanese attacks on Canada's largely undefended Pacific coast.

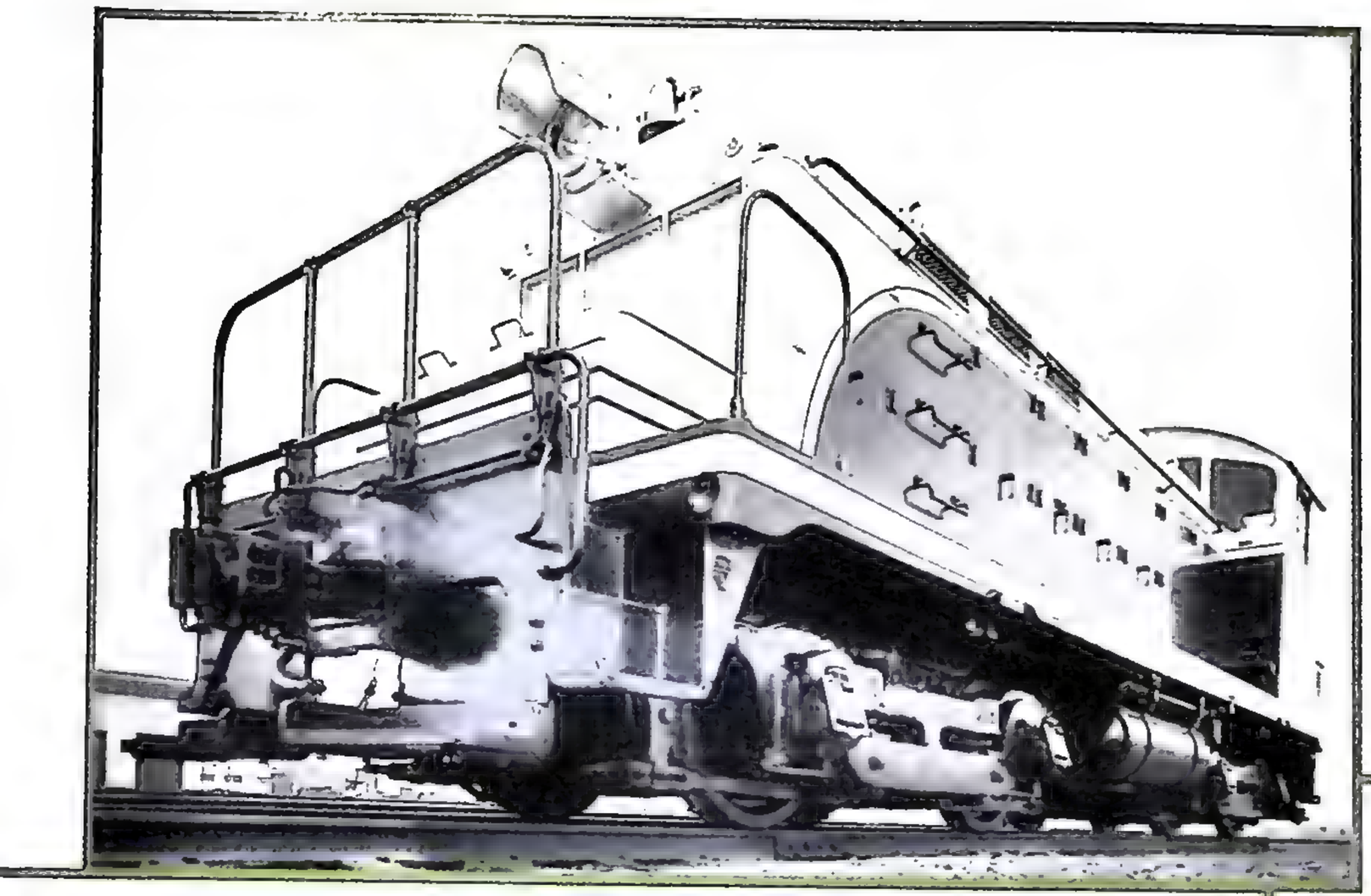
The Canadian government's desire to assemble an armored train to protect the CNR line to Prince Rupert, B.C., made CNR 9000 a celebrity of sorts for a second time. In the military's plan, rolling stock carrying munitions was disguised to resemble, as much as practical, a normal cut of freight cars. The train entered service in July 1942, with lightly armored H-10-a Ten-Wheeler No. 1426 as power.

A diesel locomotive was preferred, with the unit shrouded in an armored body intended to resemble a boxcar. CNR balked at the government's first choices for conscripted diesel motive power—box-cab 7700 and off-the-shelf GTW NW2 7902—before finally agreeing to use No. 9000. As part of 9000's government-funded September 1943 conversion, the original Beardmore prime mover was replaced with an EMD 16-567A engine rated at 1,440 h.p. Repowered, shrouded, painted khaki, and photographed with its intended consist, No. 9000 nonetheless never saw active service leading the armored train.

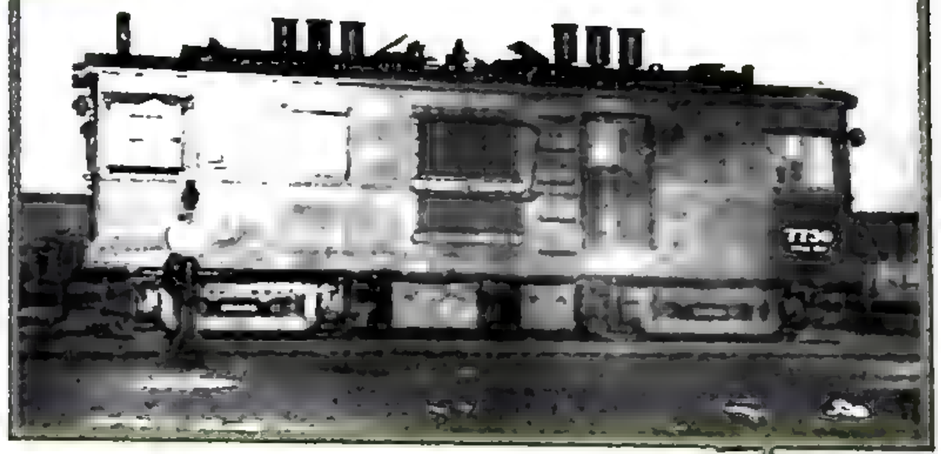
## PIONEER POSTSCRIPT

In variations of its wartime carbody configuration, after temporary storage from late 1943 through early '45, unit 9000 operated in Quebec and New Brunswick passenger service for a year after the end of the fighting in Europe. Briefly considered as a back up to the 9000 in armored train service, sister 9001 spent the entire war in storage.

By October 1946, both of the units had been officially retired and scrapped, but not before plans had been proffered for their conversion into hump units or electric locomotives, the latter for service through



Grand Trunk Western 7730, seen (below) on January 31, 1937, at the Milwaukee, Wis., carferry terminal where it served for decades, was a 1926 Brill gas-electric built for the Long Island; GTW converted it to diesel in 1939, and it became No. 73 in 1950. GTW EMC SC-model units 7800 (left) and 7801 (later 78 and 79) of 1938 were the CNR system's first "standard" end-cab switchers. CNR found a new use for old, honorable road numbers 9000 and 9001 with its first F3 A-B set, built by EMD in the U.S. in 1948. In January 1949, they arrived at Montreal (bottom) from Toronto.



GTW 7800, EMC: KEVIN HOLLAND COLLECTION; GTW 7730, LEWIS S. BUTTLES; CN F3 9000, ALAN TOOHEY

the St. Clair River Tunnel between Port Huron, Mich., and Sarnia, Ont.

Switcher 7700 was renumbered 77 in December 1950, and repowered with a 380 h.p. Caterpillar D397 engine about 1953. Retired in December 1962, the unit survives on display at the Canadian Railway Museum (Exporail) in Delson-St. Constant, Quebec, near Montreal.

On January 12, 1946, while working CNR's Montreal terminal, box-cab 7750 collided with NW2 7903 inside the 16,315-foot-long Mount Royal Tunnel. Damaged by impact and fire, both were retired. Plans to create a new switcher, assigned number 7802, from the two units' salvageable components were shelved, and the duo was scrapped in mid-1949.

The isolated nature of the assignment in Milwaukee of the Brill box-cab acquired by Grand Trunk Western in 1934 likely had a hand in the unit's longevity. Renumbered 73 in 1950, the former 7730 lasted another decade in service before retirement in June 1960; it was scrapped by GTW at Battle Creek, Mich., the following February.

After acquiring various diesel switchers during and immediately after the war, the CNR system finally revisited mainline dieselization in spring 1948 when its first EMD F3's arrived from La Grange. This was a fresh start, indeed, with 15 years having passed since Ned Brooks' untimely death and all but one of his pioneering diesel locomotives retired and scrapped.

Not quite extinguished, though, Brooks' legacy was evident when the first CNR F3A made its debut—its assigned road number was 9000. ■

# General

# Electric

## Backstage leader

Despite important early work, GE kept a low profile during the transition era

BY **GREG McDONNELL**

M. L. POWELL PHOTO, J. DAVID INGLES COLLECTION

**Best-known of GE's pre-U25B designs is the 44-tonner; 373 were built 1940-56 for 16 Class 1's and many short lines. NKP 90 is at Bloomington, Ill., in '59.**

The engine bears the name of its inventor, Rudolph Diesel, but the rise in popularity of its application to locomotives lies foremost with one of America's oldest surviving industrial concerns: General Electric.

GE, in 1905, was the supplier of electrical apparatus for what many believe to be the very first diesel locomotive anywhere. GE's Hermann Lemp [pages 46-48] designed the control systems that made the diesel-electric locomotive practical. GE built its own diesel-electrics as early as 1918, and in 1923, partnered with Ingersoll-Rand and Alco to build the first commercially successful diesel locomotives in the U.S. GE not only provided electrical equipment for Electro-Motive's early diesels, but assembled several of EMC's first diesels at its Erie, Pa., works prior to the opening of the plant at La Grange. GE was the exclusive supplier of electrical equipment for Alco diesels, and a formal Alco partner in the diesel business from 1940 to 1953. Scratch the surface of almost every major diesel builder in the U.S., and you find GE.

GE, a pioneer in the development of electric street railways and electric traction, built its first locomotive, a 30-ton electric, in 1893. By 1904, GE was investigating the potential of internal-combustion engines in railroad applications, and in 1905 provided electrical equipment for an experimental diesel designed by the International Power Co. for Southern Pacific. Powered by a pair of four-cylinder diesels from the Corliss Steam Engine Co., of Providence, R.I., in a carbody built by Alco, the locomotive tested in April 1905. Although the machine was apparently unsuccessful, it is nevertheless considered by many historians to be the first diesel locomotive.

Precursors of the diesel revolution, gas-electrics sparked GE's interest in internal-combustion power. GE completed its first gas-electric in 1906: Delaware & Hudson 1000, a combination baggage-coach powered by a 140 h.p., 6-cylinder Wolsley engine imported from Britain. The car operated on D&H for several months and served as a prototype for a line of GE gas-electric railcars.

In 1910, the same year GE began work on its 700-acre plant on the outskirts of Erie, Pa., the company embarked on a serious quest for a diesel engine. The result, based on the German Junkers design, was the GM-50 employed in GE testbed "Motor Car No. 4," in 1917, and in three 55-ton steeple-cab

EDWARD THEISINGER

**Built by Brill in 1927, Lehigh Valley 101 (at Jersey City, 1950), is one of thousands of diesels for which GE supplied electrical equipment but did not build.**

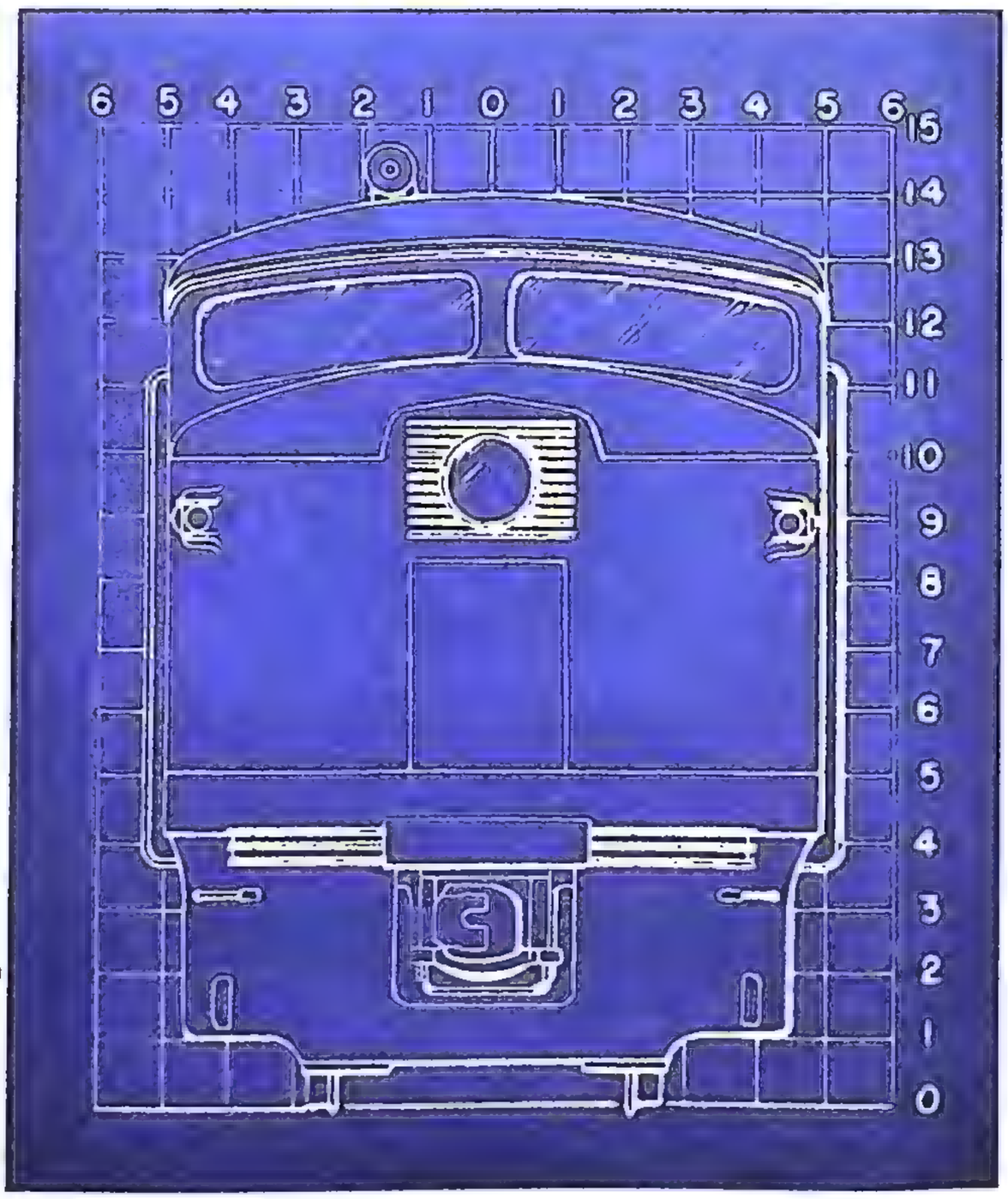
diesel-electrics in fall 1918. These units, for the Jay Street Connecting Railroad in Brooklyn, the City of Baltimore, and the U.S. Army, were not commercially successful, but they put GE one step closer to realizing its diesel dreams.

The dream became reality in 1923 with the marriage of GE electrical equipment, Lemp controls, a 300 h.p. Ingersoll-Rand diesel, and a round-ended box-cab demonstrator tagged 8835 for its GE serial number. In 1924, the 8835 embarked on a 13-month, 10-railroad, three-industry demonstration tour.

On the Jersey Central-Reading leg, it hauled a special two-car passenger train from Jersey City, N.J., to Harrisburg, Pa., becoming the first diesel-electric to be employed in road service in the U.S. More important, in day-to-day service for more than a year, 8835 proved the diesel to be both economical and reliable. From that moment, steam was doomed.

On the heels of 8835's success, Alco joined the party in 1924 and the three companies formed a consortium to design, build, and market North America's first standardized line of diesel locomotives. Using Alco carbodies, IR engines, and GE electrical apparatus, the locomotives were assembled and tested at Erie. Initially, five 300 h.p. box-cabs were built as stock. In 1925, CNJ became the first customer, putting 60-ton box-cab No. 1000 to work in the Bronx in October and staking claim to operating the first commercially successful diesel-electric locomotive.

In 1928, GE began building the carbodies for the box-cab




**The robust yet elegant styling of the flat-fronted FA and PA diesels was not the work of someone at Alco, but of Raymond Patten, a designer for GE.**

J. DAVID INGLES

**In 1966, GE 70-tonners work at Raeford, N.C., on the 30-mile Laurinburg & Southern, a typical setting for a model aimed at short lines and Class 1 branches.**

switchers, and in 1929, Alco struck off on its own (although continuing to purchase electrical gear from GE). In addition to conventional 60- and 100-ton box-cabs, GE built 44 more units equipped to operate as diesel-electrics, under battery power, and/or as straight electrics drawing power from an energized third rail or overhead catenary. Most of these units were delivered to NYC and subsidiary Michigan Central for New York City and Detroit operations; Lackawanna took two three-power units, and Rock Island acquired a two-power battery-equipped unit for switching in Chicago.

During the 1930's, GE employed Ingersoll-Rand diesels in a series of pioneering locomotives that presaged the hood-unit concept and came close to the road-switcher, still a decade in the future. Mechanically similar to CNJ 1000, but housed in an off-center-cab, hood-type carbody, the seven 300 h.p. B-B switchers went to the Bush Terminal in Brooklyn in 1931.

Even closer to the road-switcher in appearance were 10 600 h.p. B-B switchers built for New Haven in 1936. The first five units were powered by IR diesels, but the second five forecast more than the shape of things to come, with Cooper-Bessemer engines. The Cooper power plant would soon be GE's standard and would evolve to become the GE FDL engine.

While building its own locomotives, GE continued to supply electrical equipment to other builders, not just Alco but also Electro-Motive. GE's relationship with EMC dated to the days of gas-electric railcars, and when EMC needed a shop to assemble its first locomotives, GE obliged. In 1935, Erie assembled EMC's first two diesels, Lackawanna SC switchers 425 and 426, along with box-cab passenger prototypes EMC 511 and 512 and B&O 50. After La Grange opened, GE continued to supply EMC with electrical equipment until 1938, when EMC began producing its own gear, based on the GE designs.

As the drive toward dieselization intensified, GE seemed to segregate its activities. Erie continued to build mainline electrics but left the business of mainline diesels to other builders while developing its own line of light-duty diesels. In 1940, GE formalized its long-standing relationship with Alco to market diesels under the Alco-GE brand. GE contributed electrical gear and expertise, including styling the carbodies of the FA and PA cab-unit series, but the locomotives were built by Alco at Schenectady.

Meanwhile, GE introduced two of its signature diesels, the Caterpillar-powered center-cab 44-tonner in 1940 (specifically designed to be under the 90,000-lb. weight that required a fireman) and the Cooper-Bessemer-engined, end-cab 70-tonner in 1946. While EMD, Alco, Baldwin, FM, and Lima duked it out on the high iron, GE quietly dieselized short lines, branch lines, and industrial operations. Tired 4-4-0's and slide-valve Ten-Wheelers succumbed to shiny 44- and 70-tonners that often made the difference between survival and abandonment for their operators.

In 1953, GE withdrew from its partnership with Alco, but continued its role as supplier of electrical components, not only to Schenectady, but also to Baldwin and FM. While the Big Four builders finished off steam—and engaged one another in the fight for survival—GE withdrew quietly to the wings and focused its energies on developing a locomotive to do battle on the next frontier: Re-dieselization. That effort would see daylight in the late 1950's, a market entry that would ultimately, in 1983, see GE supplant GM's Electro-Motive Division as America's top diesel-electric locomotive builder, a status it still enjoys today. ■

# Steam to diesel on the Boston &

## From a 1924 gas-mechanical car to 1961 "Bluebird" Geeps

BY **CARL R. BYRON**

Dieselization of the Boston & Maine Railroad was, as with most Class 1's, a gradual process, and B&M in many ways was typical in the obstacles it faced to replace steam. At 2,000 miles the railroad was of moderate size, but it had an extensive commuter service in addition to road hauls of passengers and freight, and it ran through varied topography.

The first two decades of the 20th century marked the apogee of B&M influence and operations across northern New England. Its track-miles and quantities of employees, trains, and locomotives all peaked during 1907-1915. The 2-6-0 Mogul, 2-8-0 Consolidation, and 4-6-2 Pacific type engines built during this time were the hallmarks of B&M steam. The railroad was exclusively steam-powered from its opening in 1835 until May 27, 1911, when it began adding electric locomotives to trains going through the 4.75-mile Hoosac Tunnel in the Berkshire Hills of western Massachusetts. For the next 13 years, the 7.9-mile, 11,000-volt A.C. electric zone was the sole exception to Boston & Maine's steam status quo.

Replacement of B&M steam began with its first gasoline motor-car order in 1924, and the task was completed July 23, 1956, when the last two Pacifics clanked into the Boston engine terminal. The logic and managerial decisions made during this 32-year period are but a microcosm of the turmoil

B&M steam ended in July 1956 at Boston's South Station. A year before, on July 1, 1955, RDC's, GP7's, and an Alco RS completely outnumbered the lone steam locomotive, a 4-6-2, at left. A decade before, on August 8, 1946, at Somerville, Mass. (below), 4-6-2 3664 on train 241 to Portsmouth, N.H., raced E7 3811 on 147 to Portland, Maine.

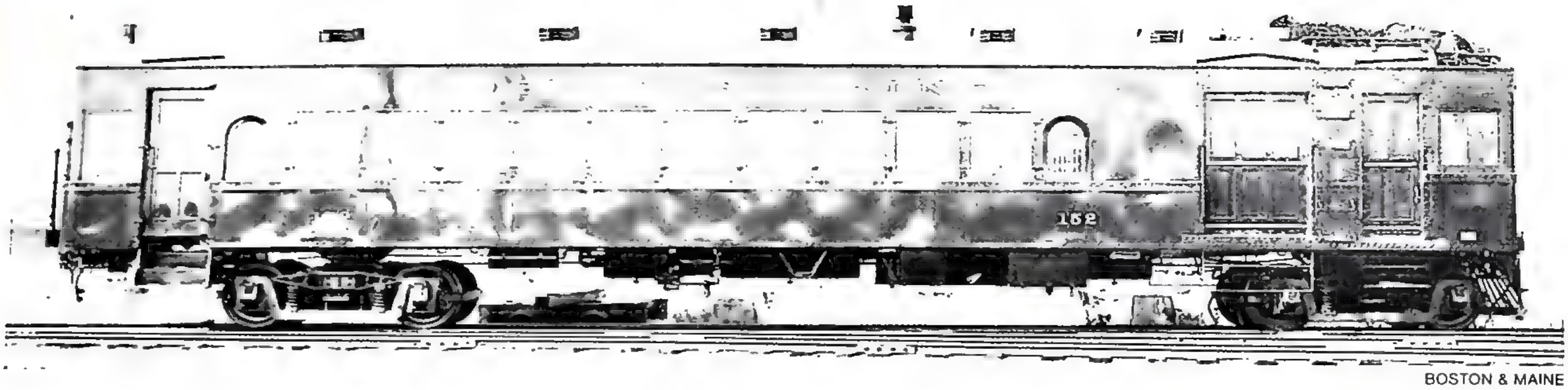
# Maine

throughout the U.S. railroad industry as its 125-year dependence on steam came to an end.

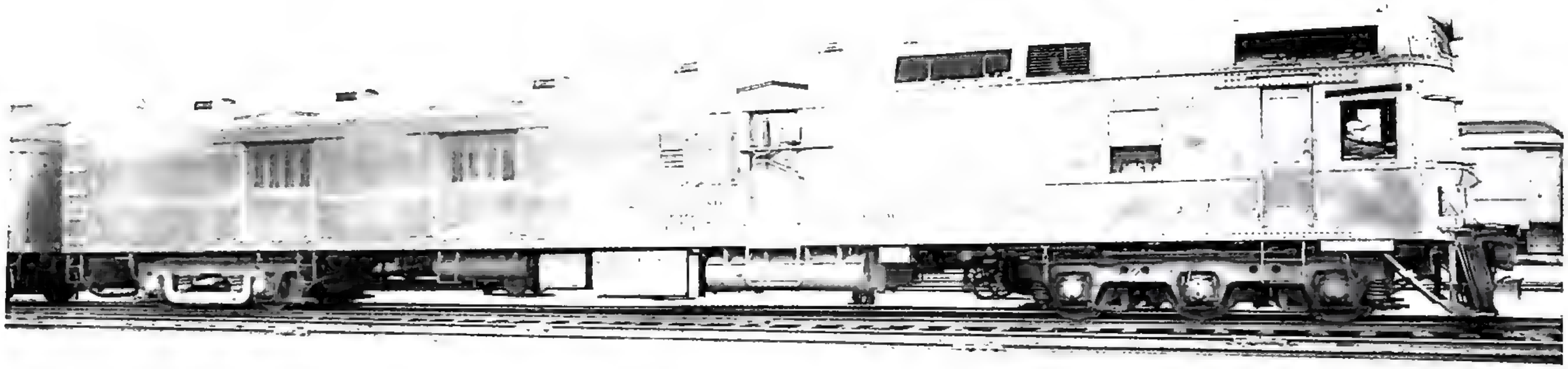
## THE MOTOR-CAR ERA

Even in their prime, most B&M branch lines had only light passenger and freight loadings. By 1917 B&M was ready to invest in a potential substitute for the Mogul- or American (4-4-0)-powered local and bought a steam-powered car, No. 100, from Laconia Car Co. of that New Hampshire city, better known for the hundreds of wooden passenger cars and cabooses it supplied to B&M and other New England roads.

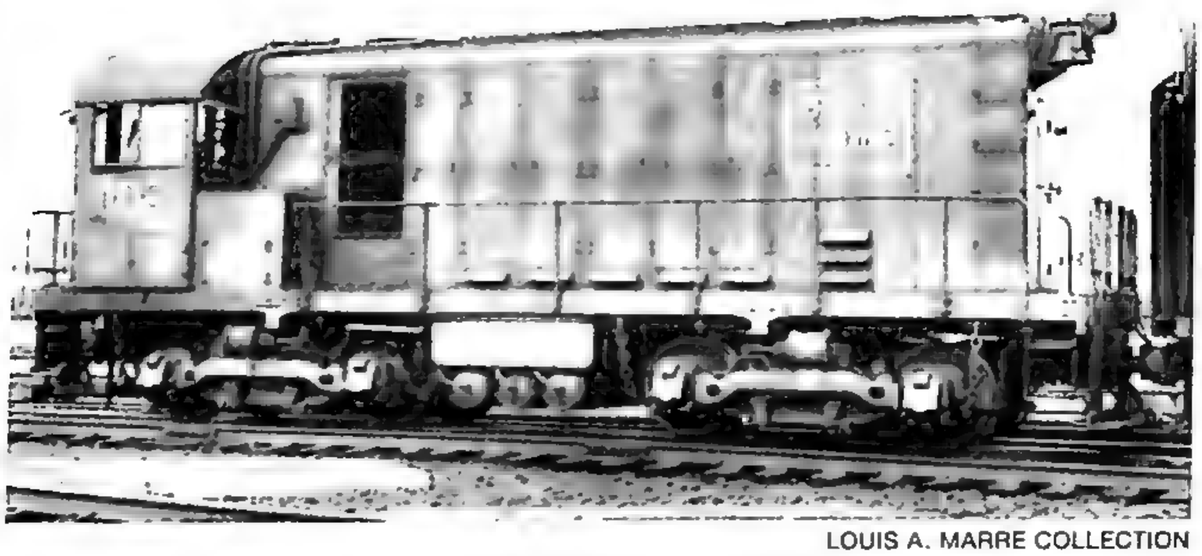
ALBERT G. HALE; TOP PHOTO, GEORGE KRAMBLES



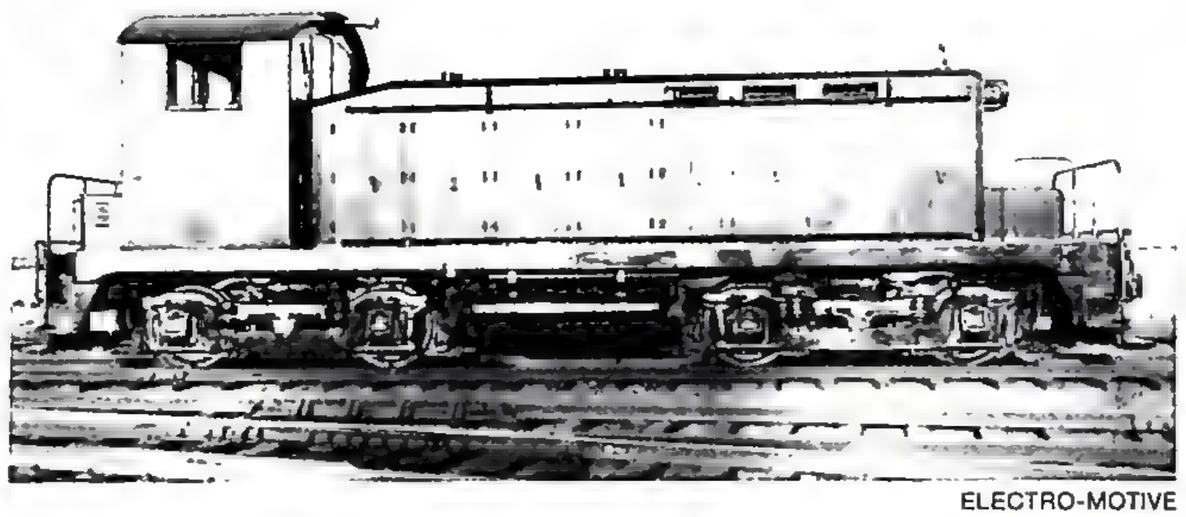

BOSTON & MAINE



WESTINGHOUSE ELECTRIC; COLLECTION OF DAVID H. HAMLEY



LOUIS A. MARRE COLLECTION



ELECTRO-MOTIVE

**Early examples of B&M steam replacements included (from top) 1926 EMC gas-electric car 152; 1935 motor car 1141, with a Westinghouse-Beardmore engine inside a St. Louis Car body; and 600 h.p. end-cab switchers from Alco-GE (1934 "high hood" 1102) and EMC (1936 SC 1103).**

This steam-powered, steel-framed passenger car resembled an electric interurban without a trolley pole. Its baggage section housed a vertical steam boiler piped to a twin-cylinder engine designed and supplied by automobile builder Stanley Steamer Co., of Springfield, Mass. The engine was nestled in the car's front truck, with the pistons connected by crankshaft and gears to the axles.

B&M 100 proved that the self-propelled car concept was viable. Its last assignment was on the 12.8-mile branch between the New Hampshire main line at Franklin, N.H., and Bristol. Sadly, on October 1, 1923, the two-stall enginehouse in Bristol—and the historic car therein—went up in smoke.

By 1919, B&M knew that automobiles were having an increasingly negative impact on its bottom line. Heavier and more powerful road engines—20 2-10-2's—arrived in 1920, while 10 medium Pacifics came in 1923, all from Alco's Schenectady Works. Five more 2-10-2's followed in 1924.

B&M's through freight and passenger trains were plentiful and still profitable, but its locals incurred operating costs of two or three times their revenue. Desiring technology based on the self-propelled concept but providing more reliability than the steam car, B&M in 1924 ordered a gas-mechanical car from Brill. Numbered 101, it contained a 175 h.p. Midwest power plant.

The next year B&M ordered a car from Stykes/St. Louis Car, with a 225 h.p. Sterling engine and a mechanical transmission (an electric transmission would be substituted in 1927). B&M also ordered six more Brill gas-mechanical cars, each powered by a Winton 190 h.p. model 110 gas engine.

The Winton engines were reliable; the mechanical transmissions assuredly were not. Accordingly, B&M in 1926 placed its first order for gas-*electric* cars, with Brill. Numbered 170, 171, and 190, each had a 250 h.p. Westinghouse-Beardmore engine and Westinghouse electrical gear. B&M also ordered three gas-electrics that year from the new Electro-Motive Co. Numbered 150-152, they were built by St. Louis Car and powered by 200 h.p. Winton 106/106A engines connected to electrical and control

GEORGE KRAMBLES; KRAMBLES-PETERSON ARCHIVE

**A clone of Burlington's *Zephyr*, B&M 6000 (at North Station as *The Businessman* on July 1, 1955), was New England's first streamliner. Budd delivered the train in February 1935.**

gear from General Electric. EMC supervised construction, warranted the finished product, and—perhaps most important to the firm's ultimate success—supplied field engineers for training of railroad personnel.

Impressed with the EMC cars, B&M immediately ordered 10 more. These had the larger 275 h.p. 120 Winton engine and GE electricals, but were built in the Osgood Bradley passenger-car plant in Worcester, Mass. All 13 EMC-Winton cars were on B&M's property by the end of 1926.

The gas cars hauled a trailer in most applications. Car and route assignments from B&M's April 7, 1927, timetable included local trains up the Connecticut River valley linking Springfield, Northampton, and Greenfield, Mass.; between Worcester, Mass., and Concord, N.H.; and between Boston and Lancaster, Mass., via the "Central Mass" branch. Running daily except Sunday, these cars totaled an as-tounding 2,491 miles on 93 trips over 20 routes every day. Twenty cars were individually assigned, allowing three to be in the shop and have one unassigned spare.

Although the Brill gas-mechanical cars served on branch lines through the late 1930's, the EMC-Winton gas-electrics lasted for three decades before new Budd Co. Rail Diesel Cars sidelined the last ones in 1956.

## ON TO THE DIESEL

In its search for improved power, B&M was well aware of the potential operational and thermal efficiency the diesel offered. In 1926, under new President George Hannauer, B&M ordered a 1,450 h.p. diesel-mechanical locomotive from the Friedrich Krupp Werks of Essen, Germany. It was to be powered by a 4-cycle, 6-cylinder inline diesel built by MAN of Nuremberg. B&M had an option to purchase 19 more. The 2-D-2 type, 314,000-lb. unit was to run on crude oil.

The locomotive was built, but the hydraulic-mechanical transmission was a complete failure, and by 1929 an exasperated B&M cancelled the order. How different diesel history might have been had B&M chosen a diesel-*electric* locomotive—one of which had been built in Germany in 1924 for the Soviet Union—and subjected it to the same requirements. It is possible that B&M then would have had 20 or more diesel-electrics on its main lines while a certain property near La Grange, Ill., was still an open field.

Steam was still the rule, though, and in 1928-29 B&M received 25 "Super-Power" 2-8-4 locomotives from Lima Locomotive Works for mainline freight service. With the onset of the Depression, B&M would order no more road locomotives for five years.

By the time the Depression began to wane in 1934, B&M did have two pint-size gas units, built in 1928 and 1930 for shop switching and such, but more important, the world of diesel locomotion had changed. American Locomotive Co., "Alco," owned McIntosh & Seymour as its diesel-engine developer and supplier. Baldwin was similarly paired with De La Vergne Engine Co., and General Motors was the parent of Electro-Motive and its engine supplier, Winton Engine Corp. Two GM-Winton 201 diesels powered the Chevrolet exhibit at the 1933-34 Chicago Century of Progress Exhibition, and talk of diesel-electric-powered streamliners was in the air.

From the 10th-floor executive suite of B&M's headquarters in Boston, the new (1930) management team, led by President Edward S. French, watched with interest the exploits of Burlington's *Zephyr* and Union Pacific's M-10000. B&M's internal monthly motive-power reports had confirmed the efficiency and substantial operating-cost reduction wrought by its fleet of gas-electric cars. Confirmation came from similar results on neighbor New Haven Railroad after its purchase of New England's first diesel yard switcher, from Alco, in 1931.

Alco completed 600 h.p. switcher 602, of the style later nicknamed "high hood," in May 1934. After a three-month trial, B&M on September 12 bought the demonstrator, its first diesel-electric. Earlier in the year, B&M had created an internal-cumbustion-powered number series, adding a "1" prefix to its 100-series gas cars. With the Krupp

R. P. OLMSTED, AL CHIONE COLLECTION

**Building blocks: Realizing it didn't need 5,400 h.p. on most freights, B&M paired 2,700 h.p. FT A-B sets with single 1,350 h.p. F2A's, exemplified at Springfield, Mass., on a northbound freight on June 8, 1956.**

unit having failed, the 1100 slot was open, but B&M earmarked it for an Ingersoll-Rand/GE switcher on order, a 600 h.p. center-cab unit with two 300 h.p. I-R inline 6-cylinder engines. It would enter service in January 1935 and work faithfully in B&M's Boston freight yards for nearly 16 years. An existing Brill car occupied the 1101 slot, so Alco 602 became B&M 1102, joining 685 steam and 7 electric locomotives.

## ANOTHER ZEPHYR, AND KIN

Boston & Maine in 1934 also ordered five heavy 4-6-2's from Lima, but more significantly, on June 8 of that year placed a $280,000 order with the Edward G. Budd Co. of Philadelphia for a streamlined passenger train, one nearly identical to Burlington's *Zephyr.* It consisted of three articulated, stainless-steel cars, with the power car up front sporting a 600 h.p. GM-Winton diesel and GE electrical gear. B&M's $225,000 Reconstruction Finance Corp. loan (a Roosevelt "New Deal" agency) covering 80 percent of the train's purchase price was approved in August, and construction began on "the first streamliner east of the Mississippi." The train arrived on B&M property on February 9, 1935.

The 113-ton, 199-foot-long speedster entered service April 4, 1935, as the *Flying Yankee* on the Boston-Portland-Bangor run (using jointly managed Maine Central north of Portland—see page 100). The streamliner cut 90 minutes off the run, covered 730 miles a day six days a week, and was a sell-out success, bringing passengers back in droves [see "The Streamlined Flying Yankee," TRAINS CLASSIC 1999].

EMC field service engineer Ernest K. Bloss, who accompanied the train to the B&M, soon joined the road's payroll as Supervisor of Motor Cars, reporting directly to D. C. ("Direct Current") Reid, B&M's autocratic general superintendent of motive power. Internal-combustion power was here to stay on the B&M, and so was Ernie, who by the mid-1950's rose to become general mechanical superintendent. In the process, he placed orders for everything from EMD FT's to Budd RDC's.

B&M, with many miles of medium-duty main lines that required two- or three-car trains of standard equipment, in spring 1935 turned to St. Louis Car for its next step in diesel development: a combination locomotive and head-end car. St. Louis built two nearly identical semi-streamlined baggage-RPO locomotives, 1140-1141, that could and did handle a train of up to six cars. Each of these power cars was 78 feet long with a 38-foot baggage section and a 15-foot Railway Post Office. Two traction motors were in each car's three-axle front truck.

The 1140 was powered by two Ingersoll-Rand inline 6-cylinder engines rated at 400 h.p. and weighed 243,000 lbs.; 1141 was lighter, at 221,700 lbs. thanks to a single 950 h.p. Westinghouse-Beardmore V-12. That engine, then the most powerful diesel in New England, utilized the first supercharger applied to a railroad diesel engine in the re-gion. In tests, the car hit 86 mph, and it ably handled a seven-car train on existing schedules. Although the *Flying Yankee* got more attention, 1140 and 1141 rolled up reliable miles of service at a fraction of the cost of the steam locomotives they replaced.

Steam still ruled on freight, though, and B&M in 1935 turned to Baldwin, ordering five dual-service 4-8-2's. They were a hit, and B&M would get 13 more during 1937-41. These 18 Mountain types, Nos. 4100-17, were the apex of B&M steam. Meanwhile, Lima delivered B&M's last steam passenger engines, heavy 4-6-2's 3715-19, in 1937. That year, a minor note of progress occurred on the internal-combustion side as B&M took baggage-RPO locomotive 1141 out of service and sold it to Texas-Mexican, having decided it was time to minimize its parts stock. Although three Westinghouse-Beardmore-powered gas cars from 1926 were still on the roster, the W-B engine was obsolete.

## BACK IN THE YARDS

Through the 1930's, B&M yard work increasingly became a diesel responsibility. Following up with its satisfied customer,

HARRY L. JUDAY J. DAVID INGLES COLLECTION

DAN POPE COLLECTION

Mighty mites: GE 44-tonner 117, at Rochestern, N.H., in 1964, wears B&M's standard switcher scheme of black with red and white trim. Some of B&M's two dozen SW1's were "road engines," in maroon and gold and with hood-top number boards, as on 1120 (right) crossing the Connecticut River bridge out of Woodsville, N.H., in October 1962.

Westinghouse in 1936 supplied B&M with a 1,600 h.p. center-cab switcher for an extended demonstration. It looked like a sure order, and B&M, having scrapped gas car 1101 in 1935, held open the number slot for it. Alas, that fall Westinghouse announced it would exit the locomotive market, so B&M returned the switcher. The 1101 slot would remain empty until a second Alco "high hood" arrived in 1938, the first production switcher powered by Alco's model 538 diesel.

Electro-Motive snagged a B&M order in 1936 for three 600 h.p. switchers, SC's 1103-05 with Winton 201A's. They arrived in August 1936, followed by three more in July 1938. EMC then changed from Winton to its own 567 diesel, and B&M's first with that prime mover, SW1's 1109-11, were delivered in November 1939. Also arriving that month were 1,000 h.p. NW2's 1200-01.

Alco delivered a third high-hood unit, 1162, in December 1939 (and 1101 was then renumbered 1161), the last of its prewar models. In 1940, B&M received its first GE 44-tonners, numbered 110-113, the only diesels it ordered that year. Three more of the midgets followed in 1941 and another in 1942. They worked in B&M's smallest yards, at such places as Woodsville and Rochester, N.H., and North Adams, Mass. One stayed around at Biddeford, Maine, into 1971.

## THE 103 DOES IT AGAIN

September 5, 1940, marked a turning point for Boston & Maine and the diesel when EMC's four-unit FT road-freight demonstrator 103 showed up. When it left 10 days later, motive-power heads were still shaking in disbelief. The 103 bested the 4100-series 4-8-2's by hauling 95 percent more westbound tonnage and 50 percent more eastbound, all without a stop for either steam pushers or the Hoosac Tunnel electrics. The handwriting covered the wall.

The fury of World War II engulfed B&M in 1942. The havoc that Nazi U-boats were wreaking on U.S. coastal shipping made rail the only reliable transportation option. By early 1943, B&M's 2-8-4's and the 4-8-2's could not keep the east-west Fitchburg Division fluid (Boston to Troy and Mechanicville, N.Y.). Something had to happen.

During October-December 1943 that "something" was six 2,700 h.p. FT A-B sets. Resplendent in bright maroon with Dulux gold trim, colors that would be in vogue for 14 years, B&M 4200AB-4205AB were delivered as three back-to-back A-B-B-A sets whose total 5,400 h.p. would pull everything the yardmaster could put behind them, and do so cleaner and more efficiently than their steam predecessors. "We ran the wheels off 'em," one retired engineer recalled. The FT's often rolled nearly twice as many miles in a month than did steam. An additional 18 FT duos arrived in February, October, and November 1944, and all kept traffic on the Fitchburg and Portland divisions moving for the rest of the war.

New power required new maintenance procedures and facilities, and during 1944-45 a new "Diesel house" of run-through design was built at Mechanicville, N.Y. Similar ones soon followed at East Deerfield, Mass., and Boston. Heavy repairs continued to be done at B&M's main shop in North Billeri-ca, Mass. Dating from 1913, this was B&M's largest shop and lasted into the Guilford era. Until the mid-1950's, diesels were painted at B&M's Concord (N.H.) Shops, which served from 1897 until 1958.

In late 1944, streamliner 6000 was assigned to *Cheshire* service between Boston and White River Junction, Vt., via Keene, N.H., and Bellows Falls, Vt. On this back-country run, its limited seating was rarely oversold. However, there was one regular passenger who could well have influenced the little train's reassignment to this rural schedule. B&M President Edward S. French traveled regularly on the *Cheshire* between Charlestown, N.H., near his home in Springfield, Vt., and B&M headquarters.

The efficiency of the FT's, plus the elimination of the submarine threat to coastal shipping, allowed B&M in July 1945 to sell seven 2-8-4's to Santa Fe and 10 more to Southern Pacific. Although Germany had surrendered on May 8, 1945, it was thought that the war in the Pacific would continue and that the Western roads would need more power.

On September 30, E7A's 3800 and 3801 arrived to debut the new "Minute Man" livery, with an emblem including the image of the famous statue at the site of the opening Revolutionary War battle in Concord, Mass., a look the FT's also soon would wear. After display at North Station, the sparkling maroon and Dulux gold-striped E7's entered passenger service on October 3, 1945, on the Boston-Portland and Boston-Troy runs.

## BUILDING BLOCKS

As early as mid-1944, B&M realized the 5,400 h.p. of an FT set was more than sufficient, and ordered 15 single 1,350 h.p. F2A units, 4250A-4264A. They came in July 1946, enabling the road to break up the four-unit FT's and make 4,050 h.p. trios of an FTA-B duo and an F2A. (The F2, built for five months in late 1946, was EMD's transition model from the FT to the F3. It sold 104 units, 74 A's and 30 B's, to nine railroads; B&M's was the third-largest fleet, behind

JERRY A. PINKEPANK

Road-switchers: An RS3 trio rolls up the Connecticut River into White River Junction, Vt., on March 19, 1965, and a decade earlier, 1550, one of B&M's four BL2's, leads a commuter train out of Boston's North Station.

GEORGE KRAMBLES; KRAMBLES-PETERSON ARCHIVE

National of Mexico and Atlantic Coast Line. Burlington and Rock Island followed B&M's example, coupling F2A's to an FTA-B set to make a 4,050 h.p. locomotive.) EMD also delivered to B&M in June E7A's 3802-15, which had off-white rear flanks.

In August, B&M "officially dieselized" the Fitchburg Division, at least from East Deerfield yard westward, the first operating division on a New England road to be "officially" shorn of steam. We say "officially" because steam still saw limited use at Mechanicville, Boston, and East Deerfield yards but was no longer assigned to through trains. Emphasizing its commitment to an all-diesel Fitchburg, B&M on August 23, 1946, turned off the 35-year-old Hoosac Tunnel electrification, the first such steam-road installation to succumb to diesels.

In September and October, three F2A-B sets arrived for "up-country" passenger service, further reducing steam mileage. All these new diesels enabled B&M on July 28, 1947, to sell 13 of its newest and most powerful steam engines, 4-8-2's 4100-4112, to Baltimore & Ohio. Several would outlast their B&M FT successors, serving into 1958.

Public Relations Manager George Hill issued a news release proclaiming that B&M operations "were over 70 percent dieselized." The roster included 24 FTA-B sets; 15 F2A's and 3 F2A-B sets; 16 E7A's; and 44 switchers: 15 SC/SW1's, 8 NW2's, 3 prewar Alco "high hoods," 3 S1's, 6 S2's, 1 GE/I-R unit, and 8 GE 44-tonners. The postwar gas-electric fleet consisted of only the Winton-EMC cars and various trailers, although baggage-RPO locomotive 1140 also continued to run. On December 31, 1947, B&M had 462 locomotives, 130 of them non-steam, but the approximate 70-30 ratio was locomotive quantity—the ratio of operations responsibility was reversed.

## THE FINAL PUSH

With the main lines dieselized, management concentrated on eliminating steam as quickly and efficiently as finances would allow. Unlike many roads, B&M stuck with just two builders, Alco and EMD (plus GE for the 44-tonners). Outlying yards were converted first, with 44-tonners in the smaller ones. Diesels without multiple-unit capability would take over the up-country passenger runs. The quantity of steam servicing facilities declined steadily until by 1955, only those at Boston remained.

In 1948, Alco had approached B&M asking to demonstrate its new RS2 road-switch-

## B&M's internal-combustion chronology

**EARLY SELF-PROPELLED CARS**

| Year | Nos. | Qty. | Type | Builder | Remarks |
|---|---|---|---|---|---|
| 1917 | 100 | 1 | Steam | Laconia Car/Stanley | Destroyed in fire, Oct. 1923 |
| 1924 | 101 | 1 | Gas-mechanical | Brill/Midwest | Scrapped 1935 |
| 1925 | 120 | 1 | Gas-mechanical | Stykes/St.L/Sterling | Elec. transm., 1927; sold '34 |
| | 121-126 | 6 | Gas-mechanical | Brill/Winton | Sold for scrap 1937-38 |
| 1926 | 150-152 | 3 | Gas-electric | EMC/GE/Winton | Sold 1943 |
| | 170-171 | 2 | Gas-electric | Brill/West./Beardmore | Scrap '47; sold NYSW '40 |
| | 180-187 | 8 | Gas-electric | EMC/GE/Winton | Blt. Osgood Bradley; sold |
| | 190 | 1 | Gas-electric | Brill/West./Beardmore | Scrapped 1947 |
| | 195-196 | 2 | Gas-electric | EMC/GE/Winton | Blt. Osgood Bradley; sold |
| 1934 | 6000 | 1 | 3-car streamliner | Budd/Winton/GE | Flying Yankee; preserved |

**LOCOMOTIVES**

| Year | Nos. | Qty. | Type | Builder | Remarks |
|---|---|---|---|---|---|
| 1926 | (1100) | 0 | Diesel-mechanical | Krupp/MAN | Order cancelled 1929 |
| 1928 | None | 1 | 18-ton gas mech. | Brookville | Shop swr.; scrapped 1938 |
| 1930 | 100 | 1 | JLB gas-electric | Plymouth | 16-ton; sold 1941 |
| 1934 | 1100 (2nd) | 1 | Center-cab swr. | I-R/GE | Retired October 1950 |
| | 1102 | 1 | High-hood swr. | Alco-GE | Ex-Alco demonstrator 602 |
| 1935 | 1140 | 1 | Bag-RPO loco. | I-R/St.Louis Car | EMD 8-567 in 1951; ret. 57 |
| | 1141 | 1 | Bag-RPO loco. | West'hse.-Beard./St.L | Sold 1940 Texas-Mexican |
| 1936 | 1103-1105 | 3 | SC, end-cab swr. | EMC/Winton | |
| 1938 | 101 | 1 | ML-8 gas-elec. | Plymouth | 30-ton, 4-wheel; sold 1941 |
| | 1101 | 1 | High-hood swr. | Alco-GE | First 538 diesel; later #1161 |
| | 1106-1108 | 3 | SC | EMC/Winton | |
| 1939 | 1109-1111 | 3 | SW1 | EMC | |
| | 1162 | 1 | High-hood swr. | Alco-GE | |
| 1940 | 110-113 | 4 | 44-ton | GE | |
| 1941 | 114-116 | 3 | 44-ton | GE | |
| | 1112-1113 | 2 | SW1 | EMD | |
| | 1200-1201 | 2 | NW2 | EMD | |
| 1942 | 1202-1204 | 3 | NW2 | EMD | |
| | 117 | 1 | 44-ton | GE | |
| 1943 | 4200-4205AB | 12 | FTAB | EMD | 6 cab-booster sets |
| 1944 | 4206-4223AB | 36 | FTAB | EMD | 18 cab-booster sets |
| | 1163-1165 | 3 | S1 | Alco-GE | |
| | 1260-1262 | 3 | S2 | Alco-GE | |
| 1945 | 3800-3801 | 2 | E7A | EMD | Minute-Man livery |
| | 1263-1265 | 3 | S2 | Alco-GE | |
| 1946 | 3802-3815 | 14 | E7A | EMD | "Rock Island" livery |
| | 4250-4264 | 15 | F2A | EMD | Mated with FT-AB for ABA |
| | 4224-4226AB | 6 | F2AB | EMD | 3 AB sets, for psgr. service |
| | 1114-1117 | 4 | SW1 | EMD | |
| | 1205-1207 | 3 | NW2 | EMD | |
| 1947 | 118 | 1 | 44-ton | GE | |
| 1948 | 119 | 1 | 44-ton | GE | |
| | 1166-1167 | 2 | S1 | Alco-GE | |
| | 3810-3819 | 4 | E7A | EMD | |
| | 4227-4228AB | 4 | F3AB | EMD | 2 AB sets, for psgr. service |
| | 1500 | 1 | RS2 | Alco-GE | Ex-Alco demonstrator 1500 |
| | 1550-1553 | 4 | BL2 | EMD | For passenger service |
| 1949 | 1501-1504 | 4 | RS2 | Alco-GE | |
| | 1530-1534 | 5 | RS2 | Alco-GE | For passenger service |
| | 1168-1172 | 5 | S1 | Alco-GE | |
| | 1118 | 1 | SW1 | EMD | |
| | 1208-1213 | 6 | NW2 | EMD | |
| | 3820 | 1 | E7A | EMD | |
| | 4265-4268 | 4 | F7A | EMD | |
| 1950 | 1173-1176 | 4 | S3 | Alco-GE | |
| | 1266-1273 | 8 | S4 | Alco-GE | |
| | 1555-1562 | 8 | GP7 | EMD | For passenger service |
| | 3821 | 1 | E8A | EMD | |
| | 4265B-4268B | 4 | F7B | EMD | Last B&M carbody units |
| 1952 | 1178-1188 | 11 | S3 | Alco-GE | |
| | 1220-1226 | 7 | SW9 | EMD | |
| | 1535-1545 | 11 | RS3 | Alco-GE | For passenger service |
| | 1563-1571 | 9 | GP7 | EMD | For passenger service |
| 1953 | 800-807 | 8 | SW8 | EMD | |
| | 1119-1132 | 14 | SW1 | EMD | |
| | 1227-1231 | 5 | SW9 | EMD | |
| | 1572-1577 | 6 | GP7 | EMD | For passenger service |
| 1954 | 860-865 | 6 | S5 | Alco | 4 rebuilt to 1000 hp 1280-83 |
| | 1505-1517 | 13 | RS3 | Alco | |
| 1955 | 1518-1519 | 2 | RS3 | Alco | |
| 1957 | 1700-1749 | 50 | GP9 | EMD | FT trade-ins; "Bluebirds" |
| 1961 | 1750-1755 | 6 | GP18 | EMD | BL2, F2 trade-ins; low-nose |

**RAIL DIESEL CARS**

| Year | Nos. | Qty. | Type | Builder | Remarks |
|---|---|---|---|---|---|
| 1952 | 6100-6101 | 2 | RDC1 | Budd | All-coach version |
| | 6300 | 1 | RDC3 | Budd | Bag.-RPO-coach version |
| 1953 | 6102-6105 | 4 | RDC1 | Budd | |
| | 6301-6302 | 2 | RDC3 | Budd | |
| 1955 | 6106-6151 | 46 | RDC1 | Budd | |
| | 6200-6211 | 12 | RDC2 | Budd | Baggage-coach version |
| 1956 | 6152-6153 | 2 | RDC1 | Budd | |
| | 6212-6213 | 2 | RDC2 | Budd | |
| | 6900-6929 | 30 | RDC9 | Budd | No controls; all-coach |
| 1957 | 6154-6156 | 3 | RDC1 | Budd | |
| 1958 | 6214 | 1 | RDC2 | Budd | |
| | 6303-6306 | 4 | RDC3 | Budd | |

er. Narrow hoods and open walkways provided the crew with excellent visibility. Its 1,500 horsepower came from a turbocharged prime mover, not a normally aspirated one, and a list price of 10 percent less than a contemporary streamlined cab unit made even EMD-leaning Supervisor of Diesel Operations & Maintenance Ernie Bloss authorize a test drive. The unit soon became B&M 1500, painted in switcher black with red front-end bands outlined in white pinstripes. Nine siblings arrived in 1949, in the Minute Man maroon livery. The improved version, the 1,600 h.p. RS3, was introduced in 1952, and by 1955 B&M had 5 RS2's and 15 RS3's in local freight service, plus 16 steam-generator-equipped versions in local passenger or commuter service.

EMD's first attempt at a road-switcher, the BL2 of 1948, was not a viable competitor against Alco's product, though B&M satisfactorily employed its four BL's in commuter and up-country passenger work for a decade. EMD soon gained road-switcher market presence, though, then dominance, with its GP7 of 1949. B&M bought 8 in 1950, 9 in 1952, and by May 1953 had 23. Some had squared-off "lighting boxes" to provide head-end electric power for coaches, as they generally displaced Moguls and Pacifics on locals and commuter trains.

Four more E7's came in July 1948 and two F3A-B passenger sets in October. Another E7 arrived in April '49, plus four F7A's as B&M followed the upgrades in EMD's catalog. B&M's last passenger cab unit, its only E8, arrived in January 1950, and a few months later, four F7B's completed its cab-unit roster.

In the postwar years, there was still plenty of work for switchers, and B&M during 1947-54 acquired 65 of 10 models from the three builders. The objective was to replace steam fast, and with specific-size units for specific jobs. GE/I-R switcher 1100 was retired in October 1950, and in May '51 the twin I-R diesels in baggage/RPO unit 1140 were replaced with an 800 h.p. EMD V-8 567. B&M's last switchers were six 800 h.p. S5's in 1954, Alco's first sale of units with its new 251 engine. They would be the only examples of that model built save one for an Appalachia coal firm, and four would be upgraded by Alco in 1963 to 1,000 h.p.

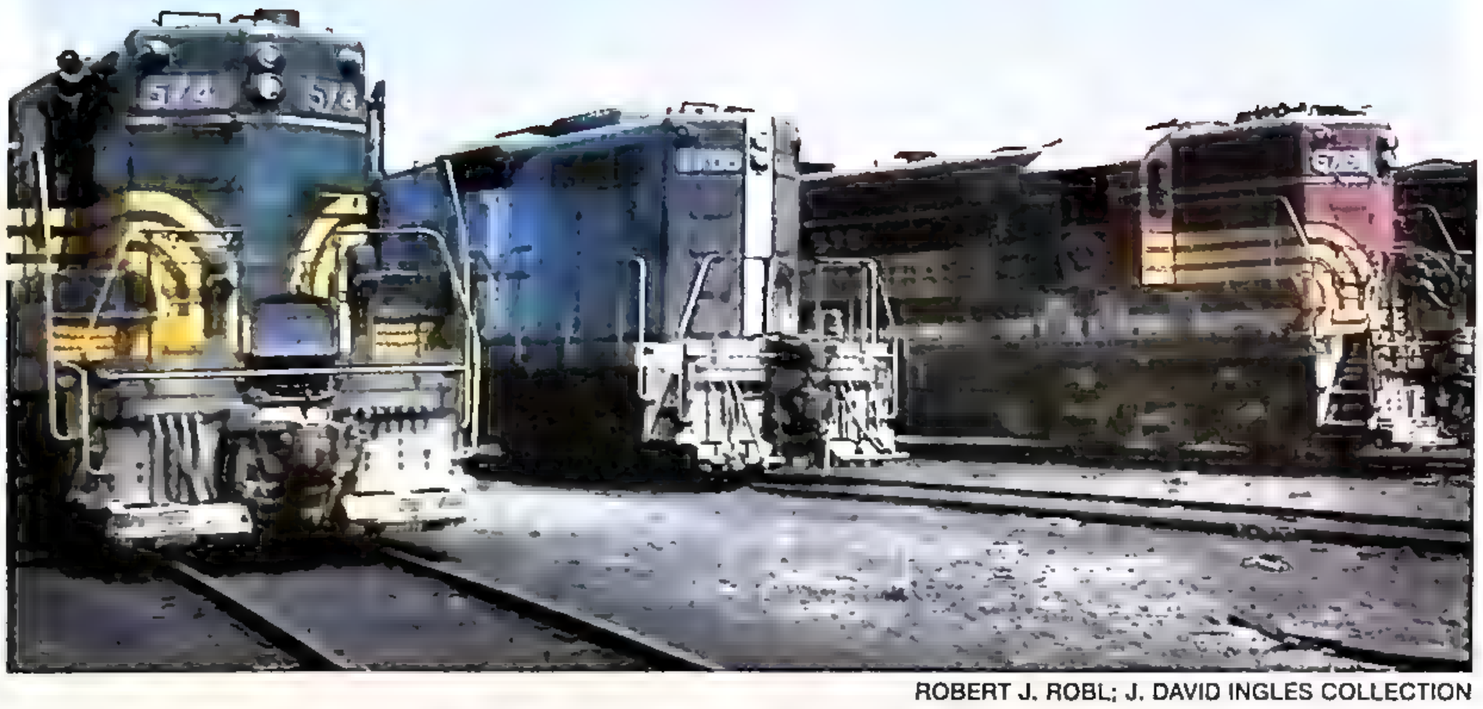
## SELF-PROPELLED, AGAIN

Budd's Rail Diesel Car, the postwar version of the old doodlebugs, made its appearance in 1949. The RDC's mechanical drive system utilized twin 275 h.p. Detroit Diesel inline 6-cylinder engines, each directly connected to a hydraulic torque converter which transmitted power via a spicer drive to the inside axle of each truck. The cars required only a two-man crew, seated up to 90 passengers, and were available in coach (RDC1), coach-baggage (RDC2), coach-baggage-RPO (RDC3), or baggage-RPO (RDC4) versions. The bright, attractive, and inexpensive-to-run stainless-steel "Highliners," as B&M called its RDC's, could be combined or split apart at junctions to be individual trains over multiple routes.

After a demonstration in December 1951, B&M ordered two RDC1's and an RDC3 for $499,000. As its passenger loadings dropped, after a couple of years of small purchases B&M embraced the concept, and by February 1956 had 67 RDC's plus 30 on order. These 30 were RDC9's, a unique single-motor design. They had no controls and operated only between other RDC's. Following the numbering logic of the *Flying Yankee*, the RDC's were 6000-series, the second digit indicating the model.

As more RDC's were due, B&M's steam-locomotive era came to a quiet close. On

## MEC, the "down East" partner



ROBERT J. ROBL; J. DAVID INGLES COLLECTION

Geeps in MEC's early (right) and later colors flank a B&M "Bluebird" in May '63 at Rigby.

**Postwar publicity photos of passenger trains** at Boston's North Station reveal the new E7A passenger diesels of the Boston & Maine and Maine Central to be identically painted: maroon with three Dulux gold stripes, or the short-lived (1946-48) maroon with one wide Dulux gold stripe and off-white rear flank (called by some, the "Rock Island" scheme). Only the road names and Minuteman or Pine Tree nose emblems differentiated them. Why? Therein is a tale.

B&M and MEC shared more than interchange at South Portland's Rigby Yard and Portland Union Station. B&M's 1885 acquisition of rival Eastern Railroad included sufficient Maine Central stock shares to make it the *de facto* owner of the Maine Central. With the 1912-14 collapse of the Morgan-Mellon empire, MEC regained independence.

In 1932 B&M President Edward S. French and his staff conceived a plan to combine senior executive positions with MEC to economize on managerial expense. By 1933 the B&M-MEC "Joint Management" arrangement was in place. Soon payroll, accounting, and other overhead functions of both roads were centralized at either headquarters, B&M's in Boston or Maine Central's in Portland.

"Jointly Managed" did not mean merged. An official merger would have required the time, effort, and expense of gaining Interstate Commerce Commission approval. Each road retained its respective mechanical department. B&M's main locomotive shop was in North Billerica, Mass., 3.75 miles southeast of Lowell, and its main passenger-car and paint shop was in Concord, N.H. Maine Central's backshop was in Waterville, Maine.

The closest coordination during the Joint Management years came near the end of World War II, when a single purchase order was issued to EMD for 20 E7A locomotives, B&M 3800-15 and Maine Central 705-708. It was the only combined locomotive order the railroads placed.

Although seven more E7's (B&M 3715-18 and MEC 709-711) were delivered in July 1948, two purchase orders were involved. Purchase coordination, but not combination, simplified bookkeeping and financing.

The E7's of both roads were found anywhere on either system through the mid-1950's. This was not the case, however, with freight road power or yard switchers, although occasionally road power did run through—in particular Maine Central F's or Geeps continuing on to Worcester, Mass., on hot through freights delivered to the New Haven Railroad, or one of the dual-service F3A-B sets traveling down to North Station. Periodically, MEC's subsidiary Portland Terminal would send a locomotive down to North Station to work off switching hours it owed to the B&M.

In 1952, French relinquished the B&M presidency, and after 20 years, Maine Central management was restive with the status quo. In 1953, freshly painted MEC E7's and F3's left Waterville shop resplendent in forest green, not maroon, with Dulux gold. New Alco and EMD power was similarly attired beginning that year. Yellow (initially Dulux gold) and green remained Maine Central colors until Guilford bought the road in 1981.

B&M and MEC continued to disentangle staff through May 1, 1955, when the new McGinnis-dominated B&M board of directors cancelled any remaining corporate relationship. The Joint Management era was over.—*Carl R. Byron*

July 23, 1956, two Pacifics, 3654 and 3662, dropped their fires at Boston after morning inbound runs from Marblehead. Diesel locomotives or Budd cars would return their patrons home that evening, and for the first time in its existence the Boston & Maine had not a single engine under steam. On September 20, the last 4-6-2's were stricken from the roster. That same year, B&M also retired its last two 1926 EMC gas-electric cars, and on December 31, 1956, only 277 locomotives—all diesel-electrics—were on its locomotive roster.

B&M ultimately would purchase 109 RDC's (one was wrecked in 1956, so it had 108), the last in 1958, and was by far the largest RDC operator. Beginning October 26, 1959, only RDC's—assisted until 1964 by a lonely Talgo train—would carry passengers to or from Boston's North Station for the next two decades, including through trains with Canadian Pacific to Montreal. B&M's only conventional passenger trains were those in New York-Montreal service via the Connecticut River valley line over the New Haven, B&M, Central Vermont, and Canadian National, whose last runs took place on Labor Day weekend in 1966.

B&M's Talgo was introduced in January 1958. Twin Fairbanks-Morse "Speed Merchant" locomotives powered the low-slung, lightweight articulated train. It was fast and flashy but rode like a Mack truck. Maine Central took one look at it in Portland and nixed any idea of Portland Talgo service, which condemned the train to commuter work until it was withdrawn in 1964. The FM opposed-piston diesel engines, the only ones on B&M, spent most of the 1970's powering metal-reduction equipment in a Leeds, Maine, scrapyard—a far longer time than they spent hauling the Talgo.

## SECOND GENERATION BEGINS

Even before B&M's last steam fires were dropped, EMD in 1956 was negotiating to implement its new "unit reduction" concept. Since new GP9's were rated at 1,750 h.p. and had higher-rated traction motors, three of them could do the work of four 1,350 h.p. FT's. With trucks, engine crankcase, blowers, traction motors, and other mechanical and electrical components "rebuilt-new" and reused in the new units, EMD quoted a 30 to 35 percent discount off list price. B&M accountants approved of the fact the locomotives could be amortized over 15 to 20 years, making them eligible for Equipment Trust Certificate financing and enabling the mechanical department to reduce its annual locomotive maintenance budget and staffing accordingly.

Acting on behalf of the new Patrick McGinnis administration, Ernie Bloss, now General Mechanical Superintendent, signed the contract to "remanufacture" all 24 FT sets into 50 new GP9's "containing some re-

Alco 1280 was one of six 800 h.p. S5's built in 1954 and among four rebuilt in '63. RDC's monopolized B&M commuter service, but also worked intercity trains, witness RDC2 6206 and a CP RDC1 at North Troy, Vt., on the Montreal-Boston run in 1962. Following the 50 "Bluebird" GP9's of 1957 were four GP18's in 1961 (at Bellows Falls, Vt., in '63).

RALPH L. PHILLIPS; J. DAVID INGLES COLLECTION

manufactured parts." From November 1956 to October 1957, groups of FT's left for La Grange, and the new GP9's in series 1700-49 arrived from February to December 1957. This first step toward the diesel's "second generation" of "trading in" FT's for GP9's also was taken by other railroads, among them Milwaukee Road and Minneapolis & St. Louis.

No FT was stripped specifically for parts to be applied to its exact GP9 replacement. The parts for rebuilding simply went into EMD's gigantic parts pool, and if the locomotive under construction was so ordered, rebuilt parts, rather than new, were used. Even today, some of the trucks under Guilford's few remaining B&M GP9's may have been delivered under FT's over 60 years ago.

The GP9's introduced the "McGinnis" colors of bright blue, black, and white, with an interlocked B+M emblem, and became known as "Bluebirds." They would be followed by six GP18's in 1961, using the four long-stored BL2's and an F2 as trade-ins.

The GP18's were B&M's last new power before the road declared bankruptcy in March 1971, and there would be no more for 12 long years. Only two more batches of new diesels would come to the B&M, in a simplified blue: 12 GP38-2's in December 1973 and 18 GP40-2's in December 1977.

Meantime, the *Flying Yankee* had been retired in 1957 after a 2.73-million-mile career. That October, as the last FT's were leaving for La Grange, the "Sacred Cow," as it was called, old 1140, was retired. (Supposedly the nickname came because it was "reincarnated" when its Ingersoll-Rand engines were replaced with an EMD 567 in 1951. Others claim the moniker arose because the hump over the engine compartment reminded them of the back of Brahmin cattle in India.) In 1958, B&M's last two Winton 201A-powered switchers were scrapped, ending service by EMC-Winton locomotives from the earliest days of the diesel era.

What steam car 100 had hesitantly begun in 1917, and a Brill gas-mechanical vehicle of 1924 really launched, was coming to a close. Before ordering the GP18's, B&M had rostered 235 diesels, and retired its last steam about the same time the majority of U.S. Class 1's did. On June 30, 1983, after 150 years of independent existence, the B&M was taken over by Guilford Transportation Industries, and a seven-decades-long motive-power saga ended. ■

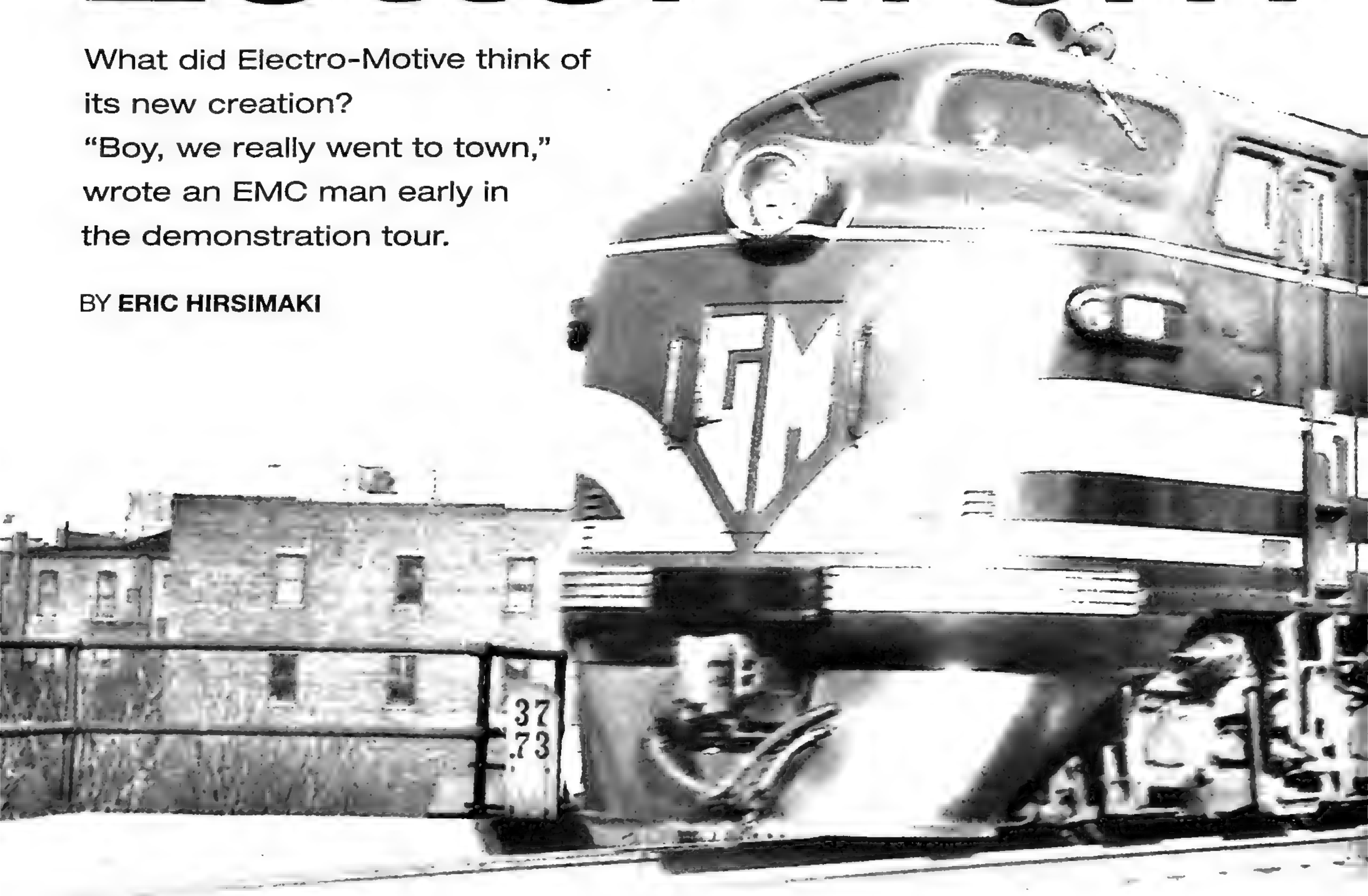
JERRY A. PINKEPANK

J. DAVID INGLES COLLECTION

# Letter from

What did Electro-Motive think of its new creation? "Boy, we really went to town," wrote an EMC man early in the demonstration tour.

BY **ERIC HIRSIMAKI**




Electro-Motive Corp.'s 5,400 h p. FT demonstrator of 1939, numbered 103, was perhaps the most influential piece of railroad motive power ever built. TRAINS Magazine Editor David P. Morgan cited the four-unit set as "the diesel that did it"—that is, doomed the steam locomotive. Owing to its impact, within two decades steam locomotives would be virtually extinct from the nation's mainline railroads.

Much has been written about 103's extensive demonstration stint during 1939-40 and the impact that the tour, and the machine, had on the railroads, yet little has been said about EMC's reaction to its newest creation. A letter (following pages), dated December 16, 1939, describes the 103's first test runs "from the inside." It was written by Clyde A. Sattley, of EMC's sales department, to the firm's founder, Harold L. Hamilton. Sattley had joined EMC in 1926, four years after its founding, so he knew better than most just how far the company had come. Perhaps more than an official report, Sattley's letter offers a behind-the-scenes look at the 103. No doubt Hamilton found the comments of interest, although he was probably confident that the 103 would meet its design goals.

Electro-Motive had made tremendous strides in the prior 10 years developing and applying the diesel engine to railroad use. In 1930 General Motors bought EMC and its engine supplier, Winton Engine Co., giving the two smaller firms access to GM's deep pockets and engineering expertise in their quest to come up with a diesel for locomotives. The effort bore fruit in 1934 when the Burlington Route used the first Winton 201A diesel engine in its revolutionary *Zephyr*, and by 1939, diesel-electric passenger locomotives and switch engines were common sights on many railroads. The one thing lacking in all diesel locomotive builders' catalogs, though, was a road-freight locomotive.

EMC developed its own engine, the 567, in 1938 to supersede the Winton 201A and was soon offering a new line of diesel passenger and switching locomotives—along with a new freight locomotive, the FT. Although the concept of a road-freight diesel was new, every component was a proven commodity, thanks to the experience gained from the hundreds of EMC locomotives then in service. All that needed

# FT 103

**With yes, exactly 103 cars in tow including the dynamometer car and a mechanical-department office car, EMC 103 puts its 5,400 h.p. to its first big test, west on the CB&Q at Aurora, Ill., December 12, 1939.**

WADE GORMAN PHOTO; RAY BUHRMASTER COLLECTION

verification was Chief Engineer Dick Dilworth's concept that a building-block approach (that is, the grouping of individual, relatively small units into a multiple-unit machine) was the best way to design such a locomotive, and that the hardware was durable enough. EMC was confident, but not until its newest creation was on the road would it know if the FT was a success.

The locomotive consisted of two pairs of drawbar-connected streamlined cab and booster units. Each unit had 1,350 h.p. for traction, which translated to 2,700 h.p. for an A-B pair and 5,400 h.p. for the entire locomotive. Given the model designation FT, the four-unit set measured 103 feet, 9 inches over end couplers and had a total weight of 1,240,000 lbs. Each unit housed a 16-cylinder 567, a model D8 main generator, and four D7 traction motors with a 62:15 gear ratio on two four-wheel trucks. Thus, unlike the passenger E units that had idler axles, 103 had all its weight on its drivers.

The four-unit set, given the road number 103 (changed from 1030 and 1031, the two A-B sets' construction serial numbers) was completed at La Grange, Ill., on November 19, 1939, and then apparently was tested and fine-tuned at the plant. On November 25, it left to begin its demonstration tour. Most likely a few road tests were made over the Indiana Harbor Belt/Baltimore & Ohio Chicago Terminal line that served the La Grange plant, as per an agreement with the builder. However, by early December, 103 was on the Chicago, Burlington & Quincy for the first road tests in revenue service. The results were everything they were supposed to be, so to say Sattley and the other EMC men were encouraged by 103's performance would be an understatement.

It's interesting to note the 5,400 h.p. locomotive was designed to approximate the performance of a Santa Fe 2-10-2, hence Sattley's frequent reference to the Burlington M-2A 2-10-2's is of particular relevance. Present during these test runs were Sattley; James H. Aydelott, General Manager, CB&Q Lines East; Henry H. Urbach, Mechanical Assistant to the Vice President; various other CB&Q officials; and the "Q's" dynamometer-car crew. Ironically, almost one year to the day from the date of the letter, 103 would be back on the Burlington. However, there's no doubt these break-in runs were the topic of conversation for some time among the railroad's officials.

Chicago, December 16, 1939

Mr. H. L. Hamilton
P.O. Box 396
Los Altos, California

Dear H.L.:

I just returned from the first trip over the Burlington R.R. with the freight locomotive #103, the run being from Clyde Yards, 7 miles out of Chicago, to Murray Yards, which is North Kansas City.

We left Clyde at 11:31 a.m. with 103 cars, tonnage - 3250 tons, arrived at Galesburg at 4:20 with 111 cars, 3520 tons, distance - 155 miles, time - 4 hours and 49 minutes. We stayed there all night and left the next morning at 6:25 with 86 cars, 2871 tons, and arrived at Quincy at 9:11, with same load, distance - 100 miles, time - 2 hours and 47 minutes.

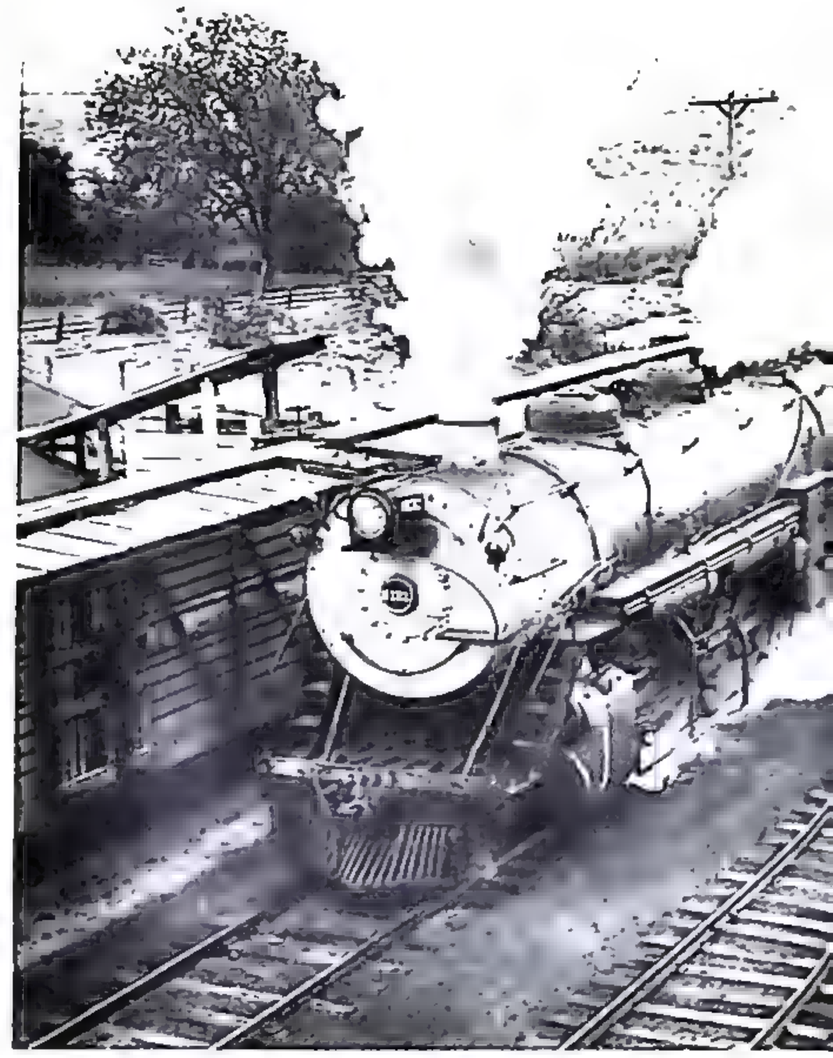
We left Quincy at 10:19 a.m. with 79 cars, 3034 tons for Murray Yards, which is 223 miles from Quincy, arriving at 5:45 p.m., but doing some switching and picking up in two or three places. The profile between Quincy and Murray Yards is very uneven, there being a succession of hogbacks over a considerable portion, causing a long train to run slack in and out. However, the going is fairly good to Brookfield, which is 104 miles from Quincy, and the Road Foreman of Engines, who was handling the job, knew something about it—by coincidence, he happens to be the father of young Fritts in Dick's Engineering Dept.—and he made a very nice run.

The schedule for No. 55, which is the fastest passenger train between those points, is 2 hours and 44 minutes and we made it in 2 hours and 55 minutes, with the tonnage as above stated. As we pulled into the station, Mr. Aydelott yelled to a Burlington man that he knew that this was "2nd 55". Not much happened from there to Murray Yards, as the tonnage did not change, but we were scheduled to arrive at Murray Yards at 6:20, and we pulled in at 5:45 after encountering some unusual delays in switching at Brookfield, Chillicothe, and one or two other places.

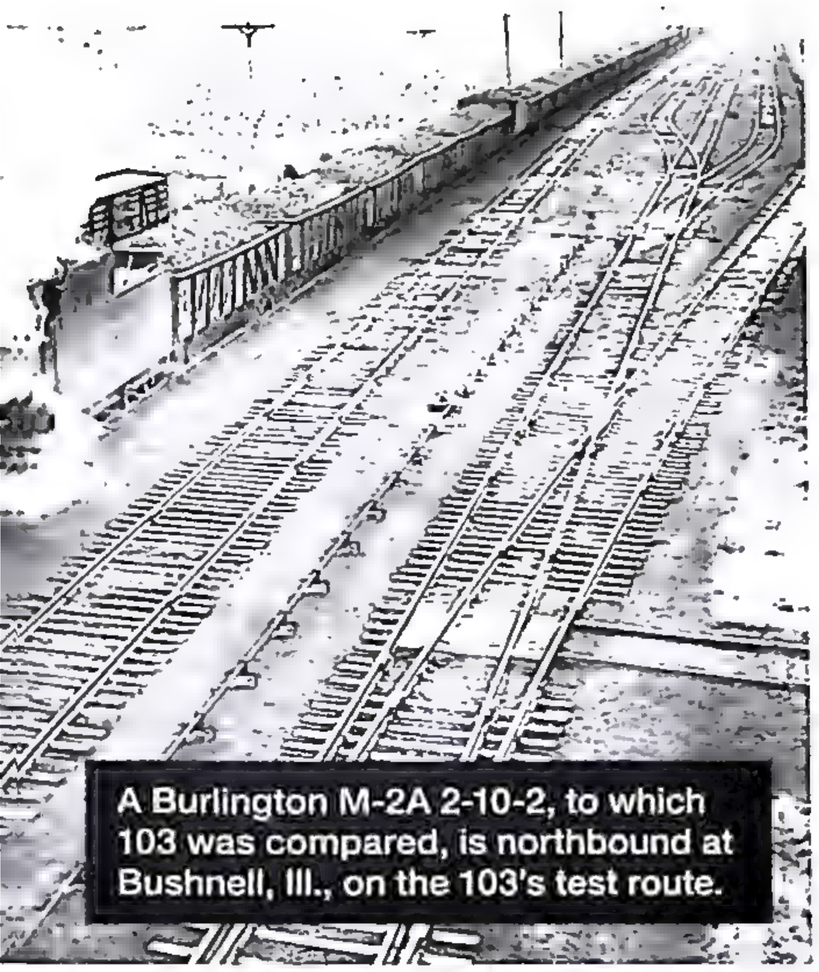
On the return trip, we left Murray Yards at 6:42 a.m. with 3098 tons, arrived at Brookfield at 11:07, after losing 20 minutes at Chillicothe, standing time, and making two stops getting into Brookfield. The tonnage was not heavy, and there was nothing particular that happened, except on Holt Hill, where the load limit for the Burlington's M2A engine, which has a tractive effort of 81,600 pounds and is normally limited to 2100 tons and with an absolute limit of 2500 tons, which they say they cannot always handle up that hill. They have figured it close enough to make a difference of 100 tons between wet rail in the morning and a dry rail later in the day when the sun has dried out the rail; in other words, 2200 tons with a dry rail. We took 3098 tons with no trouble at all.

When we arrived at Quincy, there was much discussion as to how much tonnage they would give us, as they have a grade out of there which is about 20 miles long, running from 1% to 1.22% and a 4 degree curve at the top. There was a question in the mind of some as to whether we could handle the tonnage offered, 3487 tons, up this grade and whether we would need a helper. Later, I found out they use two M2A's, which is a 2-10-2 locomotive, on a load of 2500 tons and that on the tonnage we were offered, they would have required three M2A's. We took the grade at 19 m.p.h. at the top, picking up speed gradually over most of the distance. At 17 m.p.h., we had a drawbar pull of 75,000 pounds; the maximum drawbar pull was 86,800 pounds.

Mr. Ward was up in the locomotive watching the performance and he said, "It would take three M2A's to take this train up, and then they wouldn't take it that fast", and then he said "I don't see where that s.o.b. gets its pep." The trip from the top of the grade to Galesburg was uneventful, except the speed was running along from 55 to 56 miles per hour and while we were all sitting in Mr. Urbach's car, he happened to glance at the speedometer. He said, "I can't see why we are making passenger time with 86 cars of freight. If we happened to ditch these cars, it would cost us a good many thousand of dollars, we have $10,000 worth of freight tied up, besides the value of the



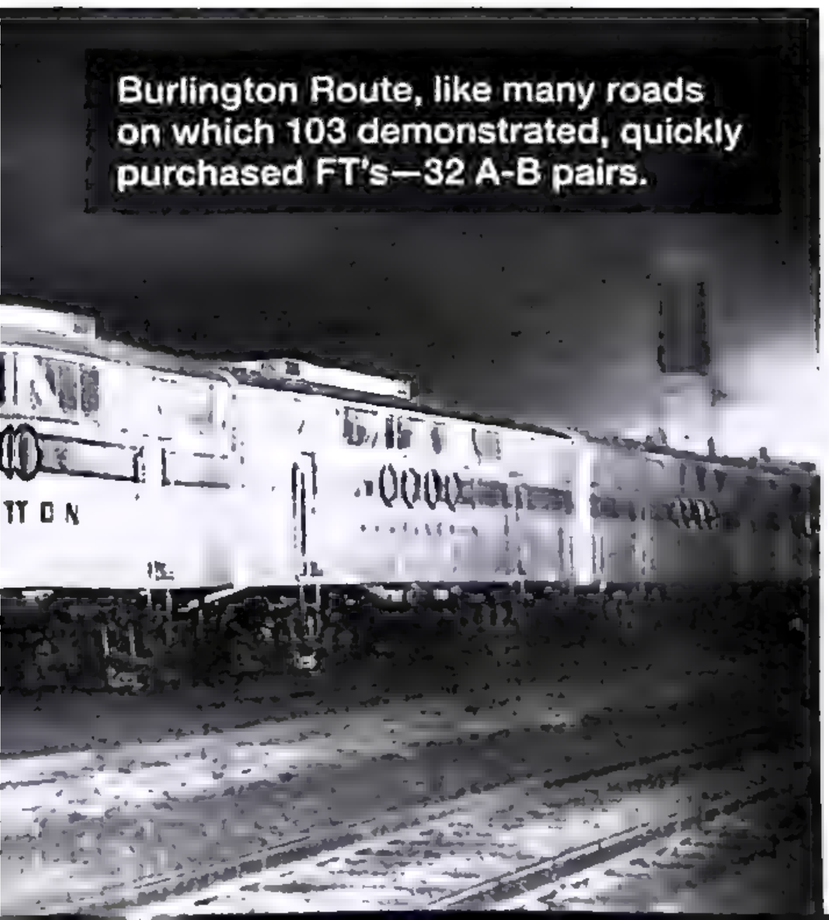
Note the "103B" numberboard as the set is delivered to CB&Q at Congress Park, Ill., on December 10, 1939.



A Burlington M-2A 2-10-2, to which 103 was compared, is northbound at Bushnell, Ill., on the 103's test route.

TOP AND BOTTOM PHOTOS, CB&Q

JOHN BOOSE PHOTO; RAY BURHMASTER COLLECTION



Burlington Route, like many roads on which 103 demonstrated, quickly purchased FT's—32 A-B pairs.

lading." So he sent word up to the engineer to observe speed restrictions, which were 50 m.p.h.

We left Quincy at 4:16, having arrived from Murray Yards at 3:36, and we arrived at Galesburg at 6:33, 2 hours and 17 minutes, which was considered an extremely good performance, considering the long grade out of Quincy.

However, the best part of the trip was from Galesburg back to Clyde. When we arrived at Galesburg, we found a pretty heavy train made up and immediately there was a caucus among the Burlington officials as to whether it was too much for us to handle, but finally it was settled that we could try. It consisted of 109 loads and 1 empty, weight 6790 tons. When Mr. Aydelott was asked about speed restrictions, he said that we needn't bother about that, because we wouldn't exceed speed restrictions anyhow. Mr. Urbach left his car on our train, and went back with Mr. Aydelott and the Superintendent and they removed their cars and had them placed on No, 56, a passenger train from Kansas City, which is due in at 8 o'clock, as they thought it would probably be 3 o'clock a.m. or more before we got there.

We left Galesburg at 7:47 p.m., and the station, where official time starts, at 7:52. We arrived at Clyde at 11:55 and at the official "checking in" time, 11:47, which was an elapsed time of 3 hours and 55 minutes. We were stopped once when the conductor threw out a fusee and the train stood for 12 minutes, while the brakeman went back to see what the matter was. The report was that somebody at the side had observed that the brakes were sticking on the wheels of the three rear cars, when we passed. When we were stopped, we had been doing about 58½ miles per hour, and we did one stretch of around 25 miles at a steady pace of 55 to 56½ miles per hour, with a drawbar pull of 25 to 35 thousand pounds.

Boy, we really went to town.

Mr. Urbach said today that is was a marvelous run and there was nothing that ever equaled that on the Burlington Railroad. He said that he and Mr. Aydelott and the other officers that came in on the two business cars, stood at the station at Galesburg and saw us leave and by the time the tail end of the train was there, it was going 35 miles per hour.

Altogether, it was a very satisfying run and I would not take a hundred dollars for my experience. One can get closer to railroad officials in such a test than in any other way I know of, and I want to go on the Santa Fe when their tests are made, at least for a trip or two. I am perfectly delighted with the performance of the locomotive. Nothing happened, engines purred around at a steady gait, temperatures were around 140 degrees, and the only mishap we had was that the horns on the front went out of commission and we had to use the rear horns.

I thought you would enjoy hearing about this test, and while you can get a more detailed report from the Burlington, this covers the highlights. They had the dynamometer car on, with a good operator and they took the speed, drawbar pull, and time at every milepost from Chicago to Kansas City and return.

Best regards, I am,
Sincerely yours,

C. A. Sattley

On January 2, 1940, the 103 was handed to the Santa Fe, on which it worked its way west. In the coming months, 103 would visit 18 more railroads and a total of 38 states, operating 83,637 miles in freight and passenger service with 100 percent availability! The 103 amazed operating officials everywhere, and the record of the set's performance did much to make the railroads believers in the advantages of dieselization. CB&Q and just about every other road 103 visited on its demonstration tour would buy FT's; a total of 1,096 FT units were sold to 23 customers. In fact, several railroads had to settle for new steam locomotives during World War II rather than the FT's they wanted because of rationing.

The 103 itself was sold to the Southern Railway in late 1940, which renumbered it 6100 and put it to work on the "Rat Hole" line running south from Cincinnati, Ohio. Today, one cab unit from this landmark locomotive is on display at the Museum of Transportation near St. Louis, Mo. ■

# On the road for Alco

A field engineer helps the railroads, and their employees, through the "transition years"

BY **ROBERT T. GRAULTY**

ROBERT T. GRAULTY COLLECTION

Ready to hit the road, Bob Graulty poses for a photo with his Alco field engineer classmates in 1949.

When World War II started, I was in high school in Troy, N.Y., working every spare minute and saving to go to Rensselaer Polytechnic Institute to become an engineer. As the war progressed, it looked like I would go directly from high school into the service just like everybody else. Instead, I was accepted in 1944 as an engine cadet-midshipman at the U.S. Merchant Marine Academy in Kings Point, N.Y. This included one year at sea in a ship's engine room. I received my degree and Marine Engineer's license in 1949, and my service obligation was ended. That June I started at the American Locomotive Co. as a field engineer in Schenectady.

Dieselization of the railroads was in full swing. Alco had ended steam production the previous year and was turning out 105 diesels per month, with a backlog of 18 months.

Our week was spent four days on shift work in the shop and one day in the classroom, where we learned about braking systems, engine design features, electrical equipment, and controls. We worked alongside the shop people, who graded our performance and treated us wonderfully. The hands-on shop experience was invaluable.

Alco built almost everything itself. We had a huge foundry, forge and hammer shops, sheet-metal shops, a truck shop, machine shops for all engine components, paint shops, complete engine and locomotive test stands, and test tracks. The shopwork was fascinating—I can remember the fabrication, machinery, welding, and assembly sequences to this day. The 539 engines were built completely in our Auburn, N.Y., plant. The 244 engine frames were welded in Auburn and machined in Schenectady. Electrical equipment, traction motors, generators, switchgear, and controls were shipped in from General Electric.

When we left to go on the road as field engineers, the shop people could not have been kinder in expressing their hopes that we did well. They gave us their home phone numbers, and truly meant it when they said, "If you have any problem, call anytime, day or night."

On the last day of training, we met with Cliff Sheen, head of field service. He was an old-timer and well-known by railroad management throughout the country. We got Mr. Sheen's earthy view of what we might expect as 20-year-olds interacting with seasoned railroaders, and what he expected from us as representatives of the American Locomotive Co. Some things I still remember:

- Your customer knows what he is doing in running his railroad
- You know only about some new equipment the customer has bought
- You are younger than just about everybody you will deal with, and you look it, so you are to wear a suit, tie, and hat
- The customer is always right, and you are to do everything and anything he wants
- There are to be no "prima donnas" or "superior" attitudes
- Schenectady would support us, and we were to support Schenectady

I was assigned to the Cleveland District, working out of Buffalo. The railroads I spent the most time on were the Pennsylvania, Nickel Plate, New York Central, Erie, Baltimore & Ohio, Lackawanna, and Lehigh Valley.

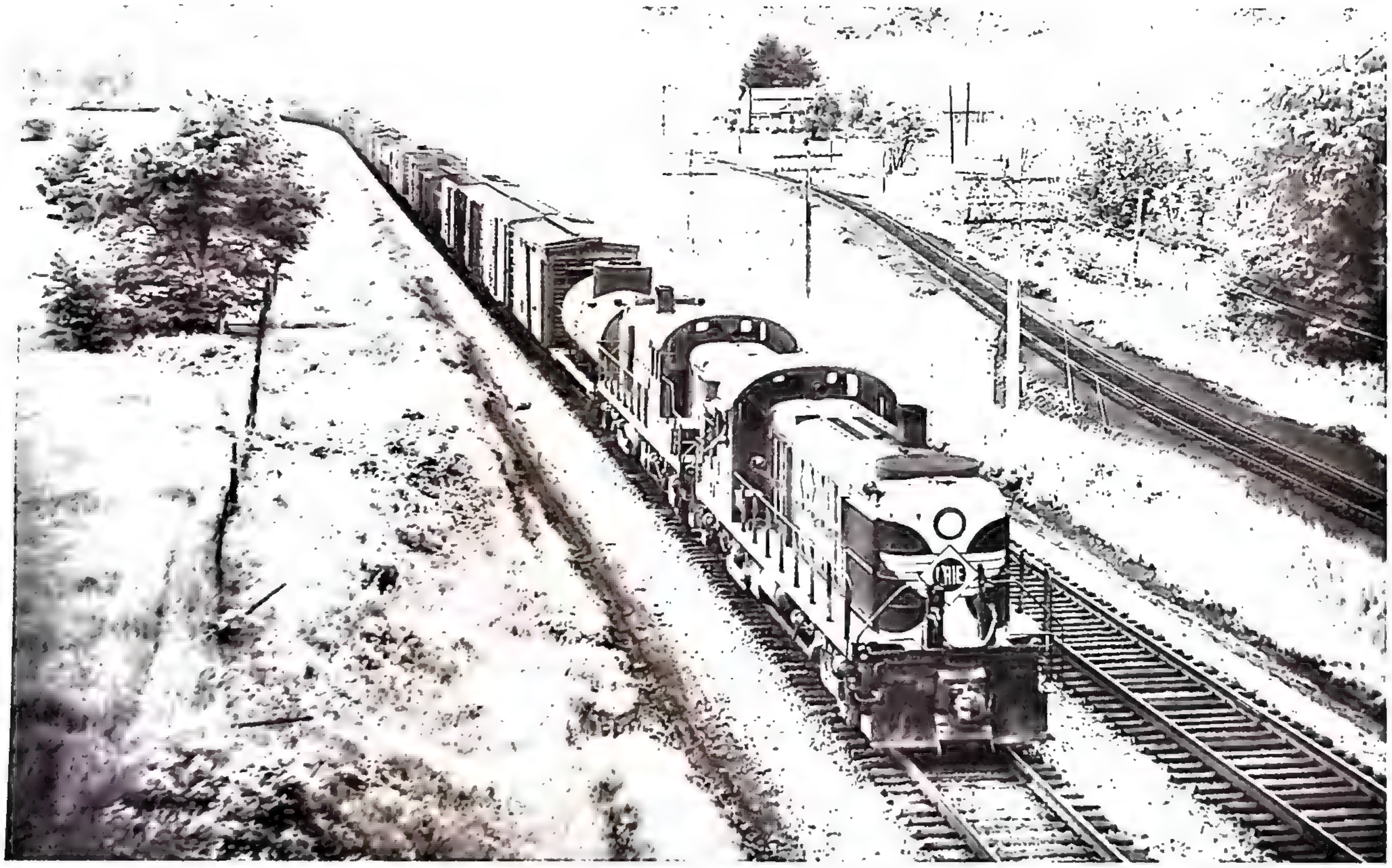
We worked alongside the shop people, who graded our performance and treated us wonderfully. The hands-on shop experience was invaluable.

## THE IMPACT OF RAPID DIESELIZATION

The rapid delivery of diesels, and the equally rapid scrapping of steam locomotives, had a dramatic effect on railroad people and operations. The use of diesels was an inevitable and logical advance, but as in many technical advances, there were interim negative human consequences. Shop workers, locomotive engineers, and firemen were laid off in such numbers that sometimes 20 or 25 years of service was needed to hold a job. Engineers were bumped back to firemen; firemen were bumped to the extra board. Trades like boilermakers were especially hard-hit.

Steam-era shops were often located in small towns. With dieselization, these shops were cut drastically and the layoffs had major local economic effects. Having grown up during the Depression and survived the war, I was very fortunate. I em-

Just after delivery, New York Central RS3's 8251 and 8350 are ahead of a 4-8-2 Mohawk on a mail-and-express train at Jordan, N.Y. The Central broke in many RS's this way.
STANWOOD K. BOLTON JR.



STANWOOD K. BOLTON JR.

**In weather more pleasant than the snowy night author Graulty spent on three Erie RS2's, a pair of RS3's (Nos. 915 and 1016) are eastbound out of Owego, N.Y., on June 2, 1951.**

pathized greatly with the railroaders and their families who had to cope with the rapid changes, and I admired them for how they dealt with it.

After the diesels arrived, shop personnel who had worked on steam all their lives had to gain the same skills on diesels: running maintenance (fix anything), monthly inspections, and major overhauls (tear an engine or component down and rebuild it). Alco provided formal classes in Schenectady and also classroom cars that were set out near shops to instruct railroad employees. We field engineers, as well as training specialists, conducted classes in these cars. The most practical and effective way of training was for a field engineer to work with a shop crew the first time they had to make a significant repair.

We would visit often, for a short time after delivery, any shop that maintained a number of new diesels, to provide the machinists and electricians repair guidance, help them become familiar with the manuals, and help diagnose trouble.

The shops had machinists, electricians, and boilermakers (who did the welding), all trades that required acceptance into a four-year apprenticeship program that included classroom and hands-on training with math, physics, and basic technical principles. I enjoyed working with machinists, especially when they would remove a diesel engine from the locomotive for the first time. They would tear it down, inspect it, measure it, and replace parts from the crankshaft on up. They would set the timing and valve clearances, check the torque on all the bolts, carefully fit all parts, seals, and bearings, and then load-test it in the locomotive.

An electrician's skills were different. Steam engines hadn't needed them much. The railroads dealt with their sudden need for electricians by bringing on new apprentices and World War II veterans, usually those with Navy electrical experience.

A major early problem was the lack of load-testing equipment in smaller shops. Without it, the best way to make an evaluation was to ride the locomotive on a run, which especially on road-switchers was physically difficult. Eventually, more load-testers were placed on the railroads, and the employees became more skilled.

Another difficulty was the lack of tools and spare parts, particularly small things. When we rode new locomotives to instruct engineers, firemen, and road foremen, the training focused on the features of the locomotive itself but not necessarily on how to handle a train. The engineers knew more about train-handling than we could ever know, even if they'd never run a diesel.

I had several operating experiences that were relatively common in the early days. I started on these runs by explaining to the diesel's engineer about the power a diesel had at both slow and fast speeds, and the need to give the steam engine a chance to get moving. I usually ended up with the engineer showing me exactly how to handle it even if he had never before run a diesel. Reflecting on that, I realized it was probably because they had run steam engines, every one of which behaved differently, even those in the same class.

## A DIESEL-STEAM EPISODE ON THE ERIE

On the Erie, during a typical heavy Buffalo snowstorm in 1949, I was in the roundhouse late one night, planning on supper and heading to the hotel, when a

road foreman came up and said he had a problem. One steam engine and three of our new RS2 road-switchers were on 50 reefers of meat that had to be in Rochester the next morning. The engineer and fireman on the RS's were new to diesels; neither engine crew had ever doubleheaded steam and diesel; and there was 2 feet of snow on the ground, with more coming. Could I ride with them? Sure, I said, remembering Cliff Sheen's pep talk.

So, at about 11 p.m., with a two-candy-bar supper under my belt, the road foreman and I were stomping through the snow on the ready track, trying to get the air-brake doubleheading cocks properly lined up so we could try our air. We soon were moving slowly toward the yard, passing crews cleaning ice and snow from the switches. As we made our way to the train, we briefed the engineer on such things as how our eight-step throttle worked, the load meter's green and yellow zones, the wheel-slip relay, and various breakers and switches. You never had to show an engineer anything on brakes except to caution him that they could easily lock a diesel's 40-inch wheels, so he had to be ready to "bail off" the engine brakes to avoid flat spots.

We coupled to the train, tested the air, and got the conductor's highball—all in pitch dark, with no radios, only hand and lantern signals. Ahead of us, the steam engine stretched the train and soon began barking hard to "get a swing on the train." In the RS2's cab, the cinders poured down on us so heavily they stalled our windshield wipers. I took the fireman out to show him a safe way to walk the running board around the nose and back to the engineer's windshield to wipe it. Feeling responsible for my safety, he wanted to do it himself, but I, likewise concerned for him, insisted that I go out, too. Through the snow and cinders, I could see the glow from the steam engine's firebox door as the fireman opened it to touch up his fire. I was worried about our generator eating the cinders and flashing over, but that didn't happen.

We were really starting to roll, and when I got back to the cab, I was afraid the diesels were starting to "run away with the train." Just at that time we could hear the lead engineer cut back. The road foreman and our engineer discussed how "strong" our engines were and how they planned to handle things from now on. Basically, he would let the steam engine run as it naturally would and use the diesels when he knew he could "help" rather than "take over." Our engineer had immediately grasped the kind of power he had. He already knew what the steam engine had, and he knew the grades and curves, so the rest of the trip went beautifully. Holding track speed all the way, we delivered the meat to Rochester early. The road foreman said it was the fastest legal run he had ever made over that division.

We hit the hotel right away because we had to take the diesels back with a train later in the day. I also had a hotel bill in Buffalo for that night, but since my candy-bar supper had cost only 10 cents, my expense account wasn't unduly taxed.

In the RS2's cab, the cinders poured down on us so heavily they stalled our windshield wipers.

## ON THE SEABOARD—AND MY ARREST FOR VAGRANCY

About March and April 1950, Alco delivered 60 RS3 road-switchers to the Seaboard Air Line. I was staying in the Hotel Buffalo when I took a phone call ordering me to Richmond, Va., where I was to see that the SAL units were placed in service. I caught a sleeping car out of Buffalo that night and arrived in balmy Richmond the next day—boots, heavy jacket, and all—and found the Seaboard shop. People there told me the railroad had changed its mind and the locomotives were going to Tampa, Fla., instead. Indeed they had, replacing all 100 steam engines maintained there, which went to scrap immediately.

Bob Fay, an Alco man who was working the Southeast, had also arrived, so we started driving in his car straight through to Tampa. Diesels were new to the Tampa shop and road people, and were arriving in twos and threes every few days. We placed the RS3's in service and went out with the road foreman and engineers the same night, aided by a third Alco man, Ray Herbert, who had come from working on the Southern Railway to the north.

We had the usual problems with so many people experiencing such a fast change. When an engine left the roundhouse, it had to go to the passenger station because the engine terminal didn't yet have fuel facilities to handle the diesels. The fuel was delivered by relatively small tank trucks, which resulted in traffic jams around the depot. It was comical to watch people come by the station in their autos and shout "Fill 'er up!" and "Get the windshield, too!"

Since field engineers were expected to support the railroad day and night, we caught our sleep and meals when and where we could. Communication in those days was not as it is now—there were no radios on the locomotives. We kept in touch by using the railroad's own phone system and dropping notes at the telegraph shanties, which were everywhere. Trains operated by Form 19 orders handed up by operators, and engine cabs would be full of string left over from the train-order forks. Whenever we could, we would work our way back to the Tampa roundhouse to make sure we covered newly arriving units.

One night, after a typical long day, I was awakened by a call from the Seaboard. A train with one of the new RS3's was barely making speed. It was jamming up the railroad, and the engines were needed for

HARRY L. JUDAY; J. DAVID INGLES COLLECTION

**Seaboard RS3's 1669 and 1668 are seen at Madison, Fla., on November 25, 1965. Perhaps one of these units was responsible for Graulty's arrest some 16½ years earlier!**

J. DAVID INGLES

**Far from the Keating Summit grade on which Pennsy hubris defeated a quartet of RS3 pushers in 1950, PRR RS3's 8458 and 8833 roll a freight into Detroit on March 24, 1964.**

other trains. Usually a railroad would come get us in a car and put us on a train, but nobody was available right then. To intercept the train, I took a taxi and then a Greyhound bus and arrived at a small town around 1 or 2 a.m. It was a quiet little town, but after all these years I don't remember where it was. A railroad building was in sight, as was a bench along the street. Since the train was not near, I took the bench and fell sound asleep. I was wearing an old jacket and was using my road-weary satchel (filled with wiring diagrams, multi-meter, voltmeter, and small tools) for a pillow, so I didn't look too great.

Suddenly I was shaken awake, blinded by a flashlight in my face. The town cop wanted to know what I was doing and, still groggy, I told the truth: I was waiting for a train. He said something like "We don't want people like you hanging around in our town," put me in his car, and took me to the home of the magistrate, who came down stairs in his bathrobe to hold court. The charge was vagrancy, and I was to pay with a fine or jail and then leave town.

At this point I really woke up and put on an "act" about our company lawyer who would sue for false arrest, and pulled out my Alco credentials. The cop and judge soon understood my story, while stating they "had a duty to keep their town clean," whereupon the officer took me back to the railroad just in time to see the ailing RS3 pull in.

The engine problem was soon fixed, and I stayed aboard for the ride to Tampa. Exhausted, I slept on the seat behind the fireman with the window for my headrest. We got back to Tampa by daylight and, wouldn't you know, some more nice new units from Schenectady were waiting to get placed in service.

## WHEN THE PENNSY DID NOT KNOW BEST

The Pennsylvania's line into Buffalo had a tough grade from Emporium to Keating Summit, Pa. There was a pusher station at the bottom of the hill with four to six steam engines assigned there, with a maintenance shop.

I was sent there in summer 1950 to help the shop and road crews with six RS3's, which were to replace the steam helpers. The morning I arrived, the shop foreman explained that the plan was to close the steam shop and just do daily trip maintenance on the diesels. The road foreman said the engineers had not run diesels before, nor had diesels been used there before as pushers.

I got a room at the Emporium Hotel, and the next day we were to make our first push up to Keating Summit. I had noted and was surprised that the trucks on the RS3's had plain, not roller, bearings—but a lot of railroads did that. We set up our four units, which was the Pennsy plan and the basis for their maximum train tonnage limit.

The train, with doubleheaded steam engines, came in, started up the grade, and stopped with the rear end opposite the shop. We coupled onto the caboose. When we heard the train air release, we started pushing. After slowly bunching the slack, we opened more throttle, and from the load meter we knew we were pushing a lot more of the train than the head end was pulling. We stayed in the green on the load meter, but the diesels started skewing badly. I couldn't believe they could skew that much and stay on the track. The couplers canted to one side until the shank hit the draft-gear housing. We had the caboose sandwiched between a train with 6,000 h.p. pushing against it and at the same time pushing it sideways.

Then, the axle-bearing end stops started smoking on the RS's. I told the road foreman we would have to cut back, and the engineer, of course, knew just how to do that without breaking the train in two. The steamers up front apparently couldn't take much more of the train. The road foreman agreed we would have to cut off and back down to the shop. Without pushers, the train had to double the hill.

I immediately got down and looked in at the swing bolsters in our trucks, and sure enough, they were not equipped for pusher service. The foremen started calling their PRR bosses, and I called Schenectady. Word came that Schenectady had recommended special bolster side pads and roller bearings for these road-switchers, but "the Pennsy knew better."

The PRR sent steam engines back up to Emporium to keep the line open. A mechanical engineer prepared sketches for the welding of heavy steel plates in the draft gear housing to limit lateral drawbar

movement, thereby stopping the skewing. I again called Schenectady, then told the railroad we did not agree with its fix and that we recommended Alco's swing-bolster kits. But the PRR wanted to try its own solution.

Next time out, as we were tying on, the conductor and brakeman refused to stay in the caboose, remarking that the yard had given them a much bigger train than they'd ever had with steam pushers (a common practice with new diesels). So they rode in the cab with us.

We started pushing. The RS3's skewed. The axle end stops smoked. We cut off the train and backed down to the shop. Steam engines pushed the train up the hill. I called Schenectady. Schenectady called Philadelphia.

The next day, I went to the PRR's Olean, N.Y., backshop, where truck modification kits had been received from Schenectady and where the six RS3's had been sent over from Emporium.

The shop crews were old-timers (the only ones with enough seniority to still be working), and boy, could they work! It was a simple modification to add the bolster side pads, but taking that type of truck apart the first time and without a drop table was not easy. All the locomotives were done within a week of two-shift days. The RS3's went back to Emporium. The skewing stopped, and there were no more problems with the RS3's on the Keating Summit grade.

## A ROUNDHOUSE GETS ITS FIRST (UNINVITED) DIESEL

In 1950, Alco was shipping a new Alton & Southern RS3 dead-in-train from Schenectady to the A&S at East St. Louis. Intended for slow-speed operation, the road-switcher had plain bearings on its trucks, not rollers. The route included running on the Canadian National across southern Ontario. We got a call from the CN telling us they had set out the locomotive for a hot journal and that they had no equipment, parts, or skills to repair it. About all they could do was slowly nurse it to their Fort Erie, Ont., roundhouse, right across the Niagara River from Buffalo.

I was sent over to see what was available and to get it repaired. Gus Praetzel, a GE service engineer from Buffalo, went along, because the shop had never worked on a diesel truck before and had limited resources for such a job. The A&S unit was placed on a pit track normally used for the replacement of steam-locomotive pony truck wheelsets. The shop workers were smart, capable journeymen, and they worked safely for three days, despite the fact that everything they touched was heavy and we didn't have an overhead crane or drop table.

What we did have was good wood for cribbing, wire rope slings, chain falls, come-alongs, bottle jacks, and a big, 1895-vintage air hoist with axle cradle located in the pony-truck pit. We blocked the locomotive frame from the floor, hung the traction motor to the frame (with cribbing from the bottom of the pit for insurance), and blocked the truck equalizers from the floor. When it was all rigged, this brand-new RS3 looked liked something out of a Rube Goldberg cartoon, but it was in control and safe.

In three days, working 'round the clock with three different crews, we changed out the front wheel and axle assembly and journal boxes.

In three days, working 'round the clock with three different crews, we changed out the front wheel and axle assembly and journal boxes. I had a cot set up beside the work so I was available to direct the men at all times and still catch some sleep, using my trusty satchel for a pillow. We were under pressure to free up the track, because it was needed for routine pony-truck work. The master mechanic, who by the time we were done had six engines waiting to get on the pit, kept checking on our progress.

We had to obtain all parts for the job from Schenectady, so we sent a list of everything we needed to make the locomotive operational. A flatbed truck arrived with all the items we'd requested, plus one I hadn't even thought of: cans of aluminum paint. In filling my order, our parts people learned the undercarriages of the Alton & Southern units were painted aluminum. This figured—A&S was owned by Alcoa. So we sent that RS3 on its way with freshly painted wheels!

## LOOKING BACK ON SOME GREAT YEARS

I worked on the road for four years, and loved it. I find it strange now to see the locomotives I put in service referred to as "first-generation diesels"—I still think of them as brand-new. I got married during this period, and my wife traveled with me for about a year, which she enjoyed in spite of some lonely times. We began our family, and all the Alco and GE district engineers and their wives, plus the railroadmen and their wives, treated us well. Our spare time was never dull.

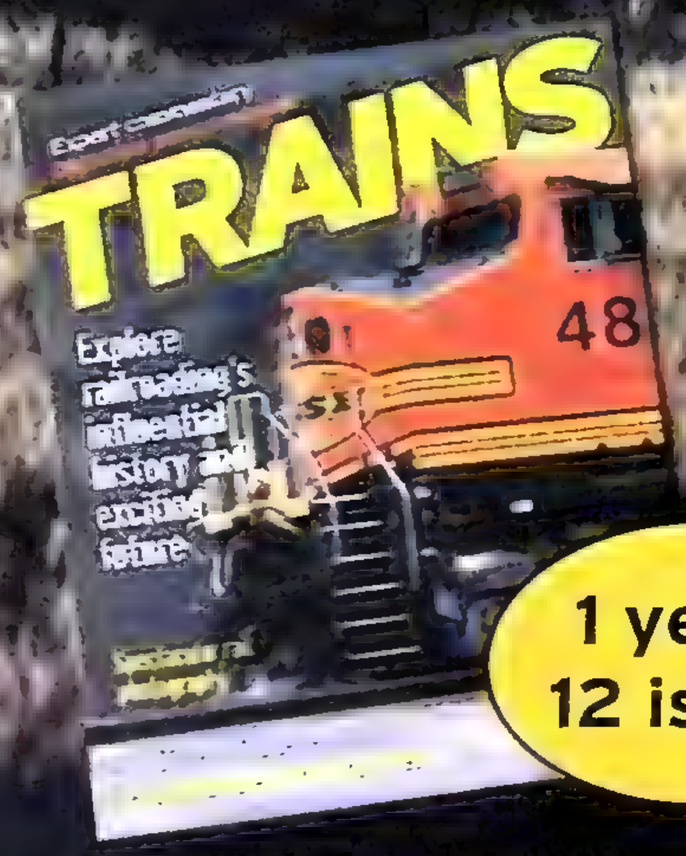
When I left the road to return to engineering in Schenectady, I worked on the development and testing of our new 251 engine, but I will always have nothing but admiration for the railroad shop and road employees with whom I worked during those "transition years." ■

J. DAVID INGLES

**Alton & Southern RS3 No. 43—the engine whose repairs Graulty oversaw from a cot in a Canadian National roundhouse—is seen in its natural habitat of St. Louis in July 1959.**

# TRAINS takes you there

Photo by Tom Danneman

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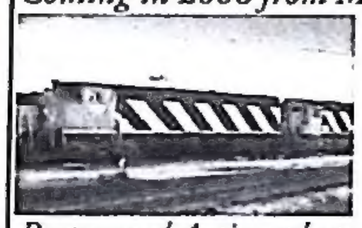

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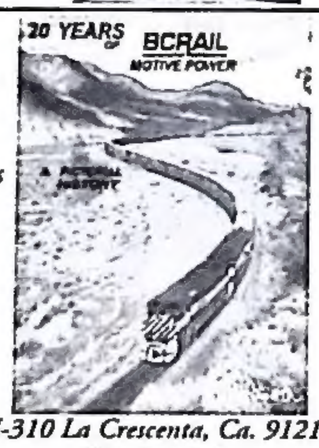


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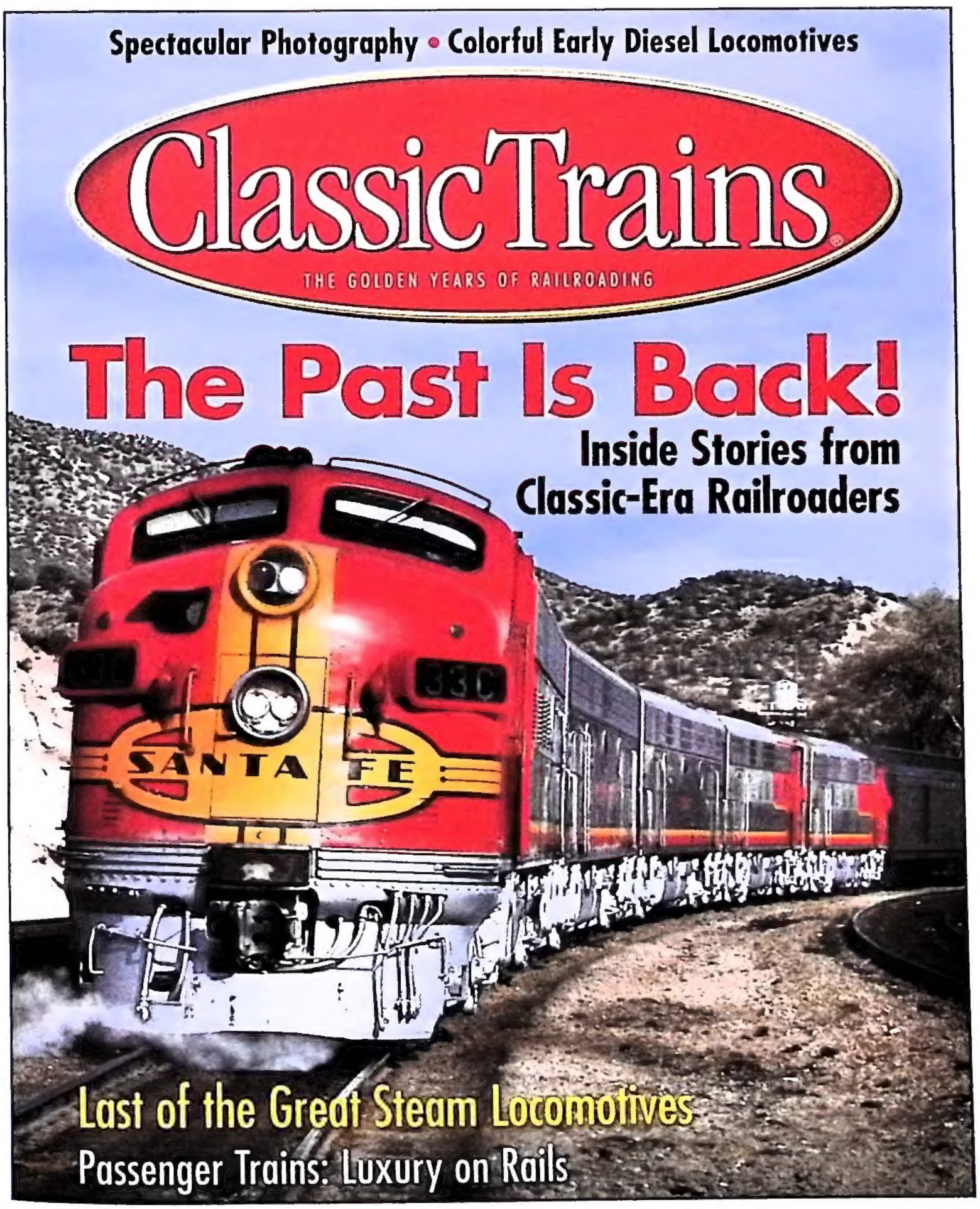
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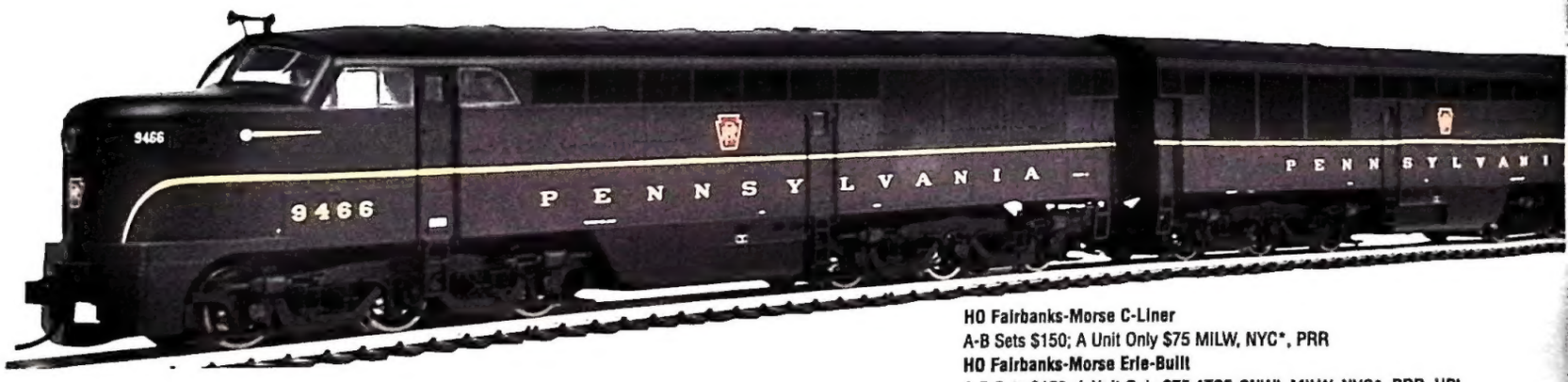


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